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| September 2020 | |

[www.africa-rising.net](http://www.africa-rising.net)

Africa RISING East and Southern Africa Project

2019/2020 Workplan

The Africa Research In Sustainable Intensification for the Next Generation (Africa RISING) program comprises three research-in-development projects supported by the United States Agency for International Development as part of the U.S. government’s Feed the Future initiative.

Through action research and development partnerships, Africa RISING will create opportunities for smallholder farm households to move out of hunger and poverty through sustainably intensified farming systems that improve food, nutrition, and income security, particularly for women and children, and conserve or enhance the natural resource base.

The three regional projects are led by the International Institute of Tropical Agriculture (in West Africa and East and Southern Africa) and the International Livestock Research Institute (in the Ethiopian Highlands). The International Food Policy Research Institute leads the program’s monitoring, evaluation and impact assessment. <http://africa-rising.net/>

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# Partners and their responsibilities

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| **Name** | **Acronym** | **Role/responsibility** |
| **Government Ministries & Entities** | | |
| District Government Authorities |  | Facilitating (farmer) contacts, supervising field activities & scaling |
| **National Academic and National Research Institutions** | | |
| Tanzania Agricultural Research Institute | TARI | Research and scaling with its Centres Selian, Naliendele, Hombolo and, Dakawa |
| Zambia Agriculture Research Institute | ZARI | Research and scaling with Msekera Research Institute |
| Sokoine University of Agriculture | SUA | Research and technology delivery; graduate student training |
| University of Dodoma | UDOM | Research and technology delivery; graduate student training |
| Lilongwe University of Agriculture and Natural Resources | LUANAR | Implementing research and scaling; graduate student training |
| **International Research Institutions and Universities** | | |
| International Institute of Tropical Agriculture | IITA | Project Management, research and technology delivery; student mentoring |
| International Center for Tropical Agriculture | CIAT | Research and technology delivery; student mentoring |
| International Crops Research Institute for the Semi-Arid Tropics | ICRISAT | Research and technology delivery; student mentoring |
| International Food Policy Research Institute | IFPRI | Monitoring & Evaluation and research |
| International Livestock Research Institute | ILRI | Research and technology delivery; student mentoring |
| International Maize and Wheat Improvement Centre | CIMMYT | Research and technology delivery; student mentoring |
| World Vegetable Centre | WorldVeg | Research and technology delivery; student mentoring |
| World Agroforestry Centre | ICRAF | Research and technology delivery; student mentoring |
| Michigan State University | MSU | Research and technology delivery; student mentoring |
| Wageningen University and Research Centre | WUR | Research and technology delivery; student mentoring |
| **Non-government and private organizations and development projects** | | |
| Cereals Market System Development | NAFAKA | A consortium of private and public development partners for taking technologies to scale |
| Dodoma Agricultural Seed Producers’ Assocoation | DASPA | Development partners assisting to take technologies to scale |
| Iles de Paix (Islands of Peace) | IDP | A consortium of private and public development partners for taking technologies to scale |
| Catholic Relief Services | CRS | Taking technologies to scale |
| Community Market for Conservation | COMACO | Taking technologies to scale |
| Total Land Care | TLC | Taking technologies to scale |
| ASFAM | ASFAM | Taking technologies to scale |
| Leadership formation, Environmental Conservation & Action for Development Foundation | LEAD | Promote best principles and practices of leadership, environmental conservation and community development |
| Community Support Initiatives Tanzania | COSITA | Scaling partner |
| Friends in Development | FIDE | Scaling partner |
| Research Community and Development Association | RECODA | Scaling partner |
| National Farmers’ Organization Tanzania | MVIWATA | Scaling partner |

# Summary

The Africa RISING East and Southern Africa (ESA) project is being implemented by multi-disciplinary research teams and development partners from the public and private sectors in collaboration with farmers and community-based organizations in Tanzania and Malawi. This document presents the work plan for the 2019-2020 research year for ESA mapped under the five Outcomes in the Phase 2 project log frame as reflected in table 3. Eighteen activity protocols are presented – four for Outcome 1; two each for Outcomes 2 and 3; and 10 for Outcome 5. Outcome 4, the functionality of input and output markets and other institutions to deliver demand-driven sustainable intensification research products improved, is absent this year since all fieldwork has been done. However, this year several papers and articles will be published under this outcome. The 2019-2020 work plan focuses more on Outcome 5 than in previous years. Outcome 5 is specifically designed to have the validated technologies delivered to stakeholders, with particular targeting of development partners, including developing their capacities to take them to scale, in line with the Phase II core approach …’to broaden our engagement with development partners who, backstopped by target Africa RISING research, will have the capacity to generate impacts at scale by applying Africa RISING innovations’. Broad categories of technologies validated to different SIAF (Sustainable Intensification Assessment Framework) domain levels are presented in the below overview.

**Table 1:** Broad categories of validated flagship technologies

|  |  |
| --- | --- |
| **Broad category** | **Validated flagship technologies** |
| Genetic integration involving introducing new crops and varieties to overcome existing biotic and abiotic stress | Drought-tolerant maize |
| Climbing bean; nutrient-dense beans |
| Short-duration pigeon pea |
| Manipulation of crop ecologies to get more crops on limited land and maximize biological nitrogen fixation | Doubled-up food legumes & mbilimbili |
| Doubled-up fodder legumes & mbilimbili |
| Cereal-legume intercropping, crop rotation |
| Integrated soil fertility management as a cost-effective approach to replenish soil fertility | Optimized fertilizer rates, composts |
| Livestock manure |
| Cover crop composts |
| Introduction of land management technologies to reduce soil loss and enhance water utilization | In situ water harvesting |
| Physical barriers to reduce erosion – ‘fanya juu’, ‘fanya chini’, and shelterbelt |
| Cover crops |
| Conservation agriculture |
| Improved livestock feed quality and quantity | Quality forage and fodder-based feed rations |
| Poultry feeds with vegetable rations and housing |
| Livestock feed with fodder rations |
| Pre- and post-harvest approaches to reduce food waste and improve food safety | Motorized shelling machine, collapsible dryer cases, PICS bags |
| Aflasafe application in maize and ground fields |
| Nutrient-rich food crops for improved household nutrition | Vegetables |
| Quality protein maize |
| Orange-fleshed sweet potato |

# Background

Phase 1 (1 October 2012 - 30 September 2016) of the USAID-funded Africa Research in Sustainable Intensification for the Next Generation (Africa RISING) project in West Africa (WA) was implemented in 25 intervention communities in northern Ghana and 9 villages in the Bougouni and Koutiala districts of the Sikasso Region in southern Mali under the *title 'Sustainable Intensification of Key Farming Systems in the Guinea-Sudano-Sahelian Zone of West Africa'*. Research activities under Phase 1 were organized around 3 research outputs (ROs), namely: 1) Situation analysis and program-wide synthesis (RO1); 2) Integrated Systems Improvement (RO2) and 3) Scaling and Delivery (RO3). Capacity building and gender were cross-cutting. Phase 2 (1 October 2016 - 30 September 2021) of the WA project was launched in February 2017.

Technological packages and/or practices validated in Phase 1 (see Table 1) are being scaled out targeting agro-ecosystems and socio-economic circumstances defined by the sustainable intensification (SI) domains - productive, economic, social, human and environmental. Linkages will be established with research and development partners to undertake both generic and back-stopping research. The generic research aims at completing the loose ends of research on the SI innovations in Phase 2 plus any other emerging issues. The back-stopping research will address researchable issues emerging from the scaling-out of SI innovations with the development partners.

Phase 2 is also exploring new research areas emerging from Phase 1 experiences and feedback by research and development partners, notably, using results from farming systems analyses and farm types to inform research targeting and technology dissemination; post-harvest management and value addition; nutrition-sensitive agriculture; labour-saving mechanization solutions for small-scale farmers; and climate-smart agriculture.

# Project logframe overview

An overview of the Africa RISING East and Southern Africa Project logframe up to the activity level can be glanced from Table 1 below. All sub-activities initiated by project partners align with specific outcomes, outputs and activities within the logframe. For a detailed look at other important logframe elements like objectively verifiable indicators, sources and means of verification, the assumptions for each output etc. the complete project logframe document is accessible at: <https://hdl.handle.net/10568/82852>

**Table 2:** Logframe overview

|  |  |
| --- | --- |
| Outcome 1: Productivity, diversity, and income of crop-livestock systems in selected agro-ecologies enahnced under climate variability | |
| Output 1.1: Demand-driven, climate-smart, integrated crop-livestock research products (contextualized technologies) for improved productivity, diversified diets, and higher income piloted for specific typologies in target agro-ecologies and scaled in Outcomes 4 and 5 | |
| Activity 1.1.1: Assess and iteratively improve resilient crop-crop and crop-livestock integration systems [Assess and iteratively improve crop-livestock combinations from Phase I] | Sub-activity 1.1.1.1 Farm level evaluation of elite drought tolerant (DT) hybrids ander validated SI soil & water conservation and fertilizer technologies to determine the huan condition, social and economic benefits associated with these hybrids |
| sub-activity 1.1.1.2 Investigations on the medum to long-term impacts of Sitechnologies (improved soi fertility management, improved germplasm, crop combinations, nutrient and water management) on vcrop productivity on multi-locational field sites and baby trials |
| Sub-activity 1.1.1.3 Determining the productivity of groundnut as a function of generation x variety x density interactions in two contrasting agroecologies |
| Sub-activity 1.1.1.4 Exploring the productivity of goats under controlled breeding and feeding regimes amon young breeding female goats in crop-livestock systems in Malawi |
| Sub-activity 1.1.1.5: Determining the productivity and resilience benefits of Gliricidia-based cropping systems |
| Sub-activity 1.1.1.6 Assess the yield, economic and BNF (biological nitrogen fixation) benefits of innovative approaches addressing the pigeon pea and common bean productivity within maize-based cropping system and variable weather |
| Sub-activity 1.1.1.7 Monitoring the impact of weather and climate variability on the productivity and resilience of maize-legume croppings of Kongwa and Kiteto, Tanzania |
| Activity 1.1.2: Evaluate and implement pathways that are effective at improving access to seeds and clonal materials of modern varieties of legumes, cereals, vegetables, forages and livestock | Sub-activity 1.1.2.1 Assessment of the benefits of management technologies on performance of improved vegetable varieties (season 2) |
| Output 1.2: Demand-driven, labor-saving and gender-sensitive research products to reduce drudgery while increasing labor efficiency in the production cycle piloted for relevant typologies in target areas [and scaled in Outcomes 4 and 5] | |
| Activity 1.2.1 Support local partners through training an appropriate drudgery-reducing technology |  |
| Activity 1.2.2: Co-adapt existing mechanization options with target communities | Sub-activity 1.2.2.1 Use of tractor mounted ripper tillage implement for enhancing soil water infiltration and moisture conservation in semi-arid areas of Kiteto, Manyara Region |
| Output 1.3: Tools (including ICT-based) and approaches for disseminating recommendations in relation to above research products, integrated in capacity development [and used in Outcomes 4 and 5] | |
| Activity 1.3.1: Conduct extrapolation domain analysis based on GIS, agro-ecology, and crop model-generated information to establish the potential of technologies for geographical reach | Sub-activity 1.3.1.1 Farmer/Extension messaging (forage production and use, crop residue processing and use and feed rations) using MWANGA |
| Sub-activity 1.3.1.2 Produce regionally relevant extrapolation domain maps for validated conservation agriculture practices |
| Sub-activity 1.3.1.3 Ex-ante impact assessment with Trade off Analysis Model for Multi-Dimensional Impact Assessment (TOA-MD) for regional relevance of evaluated Africa RISING technologies |
| Outcome 2: Natural resource integrity and resilience to climate change enhanced for the target communities and agro-ecologies | |
| Output 2.1: Demand-driven research products for enhancing soil, land and water resources management to reduce household/community vulnerability and land degradation piloted in priority agro-ecologies [and scaled in Outcome 5] | |
| Activity 2.1.1: Characterize current practices in ESA through identifying formal and informal arrangements for access to and use of water and land resources | Sub-activity 2.1.1.1 Assessing the buffer and adaptative capacity to harness the resilience of different farm types |
| Activity 2.1.2 Identify opportunities for using supplementary irrigation in different farming systems of ESA target country ecologies |  |
| Output 2.2: Innovative options for land and water management in selected farming systems demonstrated at strategically located learning sites [and scaled in Outcome 5] | |
| Activity 2.2.1 Set up demonstration and learning sites in target ESA communities | Sub-activity 2.2.1.1 Component long-term trials on maize/ legume intercropping strategies worth pigeonpea, lablab, and cowpea |
| Sub-activity 2.2.1.2 Investigations on nutrient and water management for climate resilience along a climate gradient in southern Malawi |
| Sub-activity 2.2.1.3 Test climate-smart farming practices (tied ridges, weather-informed varieties, cover crops integration [cowpea, lablab, medium duration pigeon pea]) for increasing productivity of maize-legume system under variable weather conditions |
| Sub-activity 2.2.1.4 Land rehabilitation through the integration of fodder trees and grass forage species in dryland farming |
| Sub-activity 2.2.1.5 SUA-3 Evaluation of land rehabilitation benefits of shelterbelts and contours (Soil and plant sampling from ICRAF and TARI Hombolo sites) |
| Sub-activity 2.2.1.6 Validation of residual tied ridging as a labor-saving technology in semi-arid Areas of Central Tanzania |
| Actvity 2.3.1 Conduct and evaluate participatory and inclusive testing of approaches within the demonstration sites for improving access to and use of water resources for supplementaryirrigation toi address rainfall variability |  |
| Outcome 3: Food and feed safety, nutritional quality, and income security of target smallholder families improved equitably (within households) | |
| Output 3.1: Demand-driven research products to reduce post-harvest losses and improve food quality and safety piloted in target areas [and scaled in outcome 5) | |
| Activity 3.1.1 Conduct packaging and delivery of post-harvest technologies through cimmunity and development partnerships with iterative review, refining and follow-up | Sub-activity 3.1.1.1 Assess the impact of nutritional messaging on farmers' nutritional knowledge, attitude and practices and household nutrition status, n partnership with Islands of Peace |
| Sub-activity 3.1.1.2 Evaluate influence of farmer storage structures and environemnt on physical and economic losses abatement by hermetic storage devices |
| Output 3.2: Nutritional quality improved through increased accessibility and use of nutrient-dense crops and livestock products | |
| Activity 3.2.1: Promote and deploy nutrient-rich crop varieties and livestock feed resources in target communities | Sub-activity 3.2.1.1. Elucidate pathways to sustainable adoption of nutrient diets and aflatoxin mitigation practices in rural communities of Central Tanzania |
| Sub-activity 3.2.1.2 Promote farmer production of nutrient dense (Zn, Fe) SER83 and NUA45 bean varieties produced by CIAT during 2018 |
| Sub-activity 3.2.2.3 Determining the quality and safety of locally produced legume grain-derived complementary foods and adoption in Dedza District |
| Sub-activity 3.2.1.4 Assess the contributon of the farming systems interventions in narrowing the food and nutrient gaps in Kongwa and Kiteto and the probability of smallholder farmers to meet hem |
| Output 3.3: Capacity of farming communities and partners to consume nutrient-dense crops and livestock products enhanced | |
| 3.3.1 Conduct packagaing and delivery of poast-harvest technologies through community an development partnershipswith iterative review, refining and follow-up |  |
| Outcome 4: **:** Functionality of input and output markets and other institutions to deliver demand-driven sustainable intensification research products improved | |
| Output 4.1: Access to profitable markets for smallholder farming communities and priority value chains facilitated | |
| 4.1.1 Conduct comprehensive value-chain analysis with specific focus on SI technologies |  |
| 4.1.2 Conduct a value chain stakeholder analysis (stakeholder mapping) |  |
| 4.1.3 Develop a value chain enhancement strategy (including collective actiob approaches, contractual agreements, standardaization) |  |
| 4.1.4 Identify and evaluate existing mechanisms that inform farmers about dynamic market needs |  |
| 4.1.5 Conduct an analysis of the existing base line survey data and supplement them with qualitative surveys from target regions |  |
| Outcome 5: Partnerships for the scaling of sustainable intensification research products and innovations operationalized | |
| Output 5.1: Opportunities for the use and adoption of sustainable intensification technologies identified for relevant farm typologies | |
| Activity 5.1.1: Farmer participatory experimentation with crop and soil management and integrated crop-livestock technologies in on-farm situations | Sub-activity 5.1.1.1 Continued experimentation in 6 target communities of Eastern Zambia and 9 communities in in Central and Southern Malawi with already established clustered CA trials |
| Sub-activity 5.1.1.2 Explore the productivity domains of selected legumes and cererals to elucidate their best fitting cropping system at community/landscape level and their dissemination |
| Sub-activity 5.1.1.3 Engage develpoment partners to identify technologies of interest for partnership dissemination |
| Sub-activity 5.1.1.4 Case-studies: Application of SI technologie use among farmers interacting with Africa RISING at different intensities |
| Activity 5.1.2 Use farm trial data to apply crop simulation models (APSIM) and assess performance over space and time, including assessment of climate-smart technologies to establish the poiotential for adaptation and mitigation | Sub-activity 5.1.2.1 Apply APSIM crop simulation model to assess changes in resource use efficiencies, productivity and profitability of the different cropping systems in Kongwa, Kiteto and Iringa in Tanzania |
| Sub-activity 5.1.2.2 Evaluate the potential contributions of integrated soil-fertility management around the five SIAF domains with emphasis on Africa RISING interventions in Tanzania |
| Activity 5.1.3: Establish adaptive field experiments with mineral and animal-derived organic manure | Sub-activity 5.1.3.1 Rainfall-responsive nitrogen fertilization strategies: in search of increased nitrogen use efficiency by smallholder farmers under rainfed conditions |
| Sub-actvity 5.1.3.2 Assessing the effect of residue quantity and quality and water conservatpon on maize productivity and nitrogen dynamics on smallholder farms in Malawi |
| Sub-activity 5.1.3.3 Assesing integrative effect of in situ rainwater harevsting and fertilizer microdosing on crop yield, water and nurtrient use efficiency in Kongwa dstrict |
| Activity 5.1.4: Demonstrate the use and impact of crop residues, forages, and other organic resources as animal feed and nutrient resources | Sub-activity 5.1.4.1 Test the effect of feeding napier grass and maize supplmented with bean haulms at different levels of mil yield under smallholder farmer conditions |
| Sub-activity 5.1.4.2 Demonstrate the effect of home-made feed rations based on Gliricidia sepium and vegetable waste on productivity of selected strains of chickens |
| Activity 5.1.6: Disseminate best-fit integrated crop-livestock technologies to reach and have effect on small-scale farmers in a landscape context | Sub-activity 5.1.6.1 Small-scale piloting of FarmMATCH – a framework for typology-based targeting and scaling of agricultural innovations. (Matching Agricultural Technologies to Farms and their Context) |
| Activity 5.1.7: Conduct cost-benefit and gender analysis coupled with other socio-economic analyses to identify and quantify adoption constraints and opportunities for different farmer contexts | Sub-activity 5.1.7.1 Socio-economic studies on cost-benefits of CA systems, labor, nutrition and gender in target communicties of Malaw8i and Zambia conducted |
| Sub-activity 5.1.7.2 Gender analysis of soil and water conservation technologies |
| Sub-activity 5.1.7.3 Innovative farmer survey applying SI principles in CA long-term trials in Malawi and Zambia |
| Output 5.2: Strategic partnerships with public and private, initiatives for the diffusion, and adoption of research products established | |
| Activity 5.2.1: Map and assess relevant stakeholders to establish dialogue for the exploration of mutual synergies for scaling delivery of validated technologies | Sub-activity 5.2.1.1 Engage able and willing partners to develop a strategy and implementation framework for scaling up intensification technologies in semi-arid ecologies of central Tanzania |
| Activity 5.2.2: Leverage/link and integrate (engagement and outreach) with existent initiatives including Government extension systems to support and encourage the delivery pathways | Sub-activity 5.2.2.1 Support the Ministry of Agriculture and NGO extension in scaling CA systrems in Eastern Zambia and Malawi |
| Sub-activity 5.2.2.2 Engage with seed companies to accelerate release & scaling of new DT hybrids |
| Sub-activity 5.2.2.3 Partnership with Iles de Paix (IDP) for increasing the adoption of improved vegetable varieties and good agricultural practices for scaling delivery of validated technologies |
| Sub-activity 5.2.2.4 Partnership with the LEAD foundation to take to scale soil and water management technologies in erosion-prone areas |
| Output 5.3: Gender-sensitive decision support tools for farmers to assess technology-associated risk and opportunities used by partners | |
| Activity 5.3.1: Identify and communicate gender-sensitive decision support technologies in the context of different farm typologies | Sub-activity 5.3.1.1 Role of gender from farm-to-fork and the market of grain legumes and dryland cereals in Kiteto and Kongwa (data already collected and partly presented; more in-depth analysis needed) |
| Output 5.4: A technology adoption, mionitoring, evaluation, and learning framework for use by the project team and scaling partners released [led by IFPRI and used by project partners] | |
| Activity 5.4.1 Monitor and modify the progress of technology adoption process towards scaling |  |
| 5.4.2 Develop knowledge sharing centers and learnng alloances within existent local and regional institutions |  |

# Planned work

The planned activities are presented in the protocols. Activities under each protocol are aimed at achieving the outputs under the four outcomes in the project logframe

(see Table 3).

## Outcome 1: Productivity, diversity, and income of crop-livestock systems in selected agro-ecologies enhanced under climate variability

|  |  |  |  |
| --- | --- | --- | --- |
| a. Output 1.1 | | Demand-driven, climate-smart, integrated crop-livestock research products (contextualized technologies) for improved productivity, diversified diets, and higher income piloted for specific typologies in target agro-ecologies | |
| b. Activity 1.1.1 | | Assess and iteratively improve resilient crop-crop and crop-livestock integration systems | |
| c. Sub-activity 1.1.1.1. | | Farm-level evaluation of elite drought tolerant (DT) hybrids under validated SI soil & water conservation and fertilizer technologies to determine the human condition, social and economic benefits associated with these hybrids | |
|  | | | |
| d. Research team | | | |
| Name | Institution | | Role |
| Bright Jumbo | CIMMYT | | PI |
| Elirehema Swai | TARI – Hombolo | | To provide support on monitoring field activities on the ground to facilitate timely action concerning activities such as weeding, fertilizer application, data collection and harvesting |
| IFPRI | IFPRI | | To provide support in monitoring the research activities to ensure compliance with the FtF monitoring system including periodically assisting in data collection (both FtF and Custom indicators data) with critical gender perspective and uploading into the FtF system |
| Yasinta Muzanila | SUA | | Lab analysis of maize grain for nutritional properties |
|  | | | |
| e. Student(s) | Nil | | |
|  | | | |
| f. Location(s) | The following sites/villages will be used: Iringa district (Ismani, Igula, Kihorogota, Ndoela); Kongwa district (Mlali & Ng’humbi) and Kiteto district (Kiperesa) | | |
|  | | | |
| g. Start date | October 2017 | | |
|  | | | |
| h. End date | September 2020 | | |
|  | | | |
| 1. Justification | | | |
| Kongwa, Kiteto and Iringa in Tanzania face several challenges in crop production. The productivity of smallholder agricultural systems has significantly declined due to factors such as a decline in soil fertility, crop diseases, incidences of pests (fall armyworm) and drought which has become a very serious challenge with a high occurrence frequency. The 2018/ 2019 crop growing season was severely affected by drought across the Manyara and Dodoma regions. Development and deployment of crops that have the resilience to such biotic and abiotic stresses in this region, integrated with soil & water conservation measures can help reduce the effect of drought on smallholder production systems. During 2019, 12 drought-tolerant maize hybrids were selected from the 2017/2018 trials conducted across 7 sites for yield and agronomic performance, were tested at plot level through validation trials for their yield and agronomic performance across seven sites. The four best hybrids were selected based on the 2019 test results. Based on gaps identified as summarized in the opening section, there is a need to collect more data, especially for systems approach analysis, economic, social and human condition domains. The selected hybrids have been planted at 7 sites in mother trials and 20 sites as baby trials. Among the 7 sites, 3 are new sites. | | | |
|  | | | |
| 2. Objectives | | | |
| 1. Test 4 DT hybrids for yield and agronomic performance under two tillage practices; fertility and under researcher and farmer management practices. The use of farm-level experiments will help analyze data with application of systems approach to understand system performance based on the contribution from the variety.    1. Determine Genotype x Environment x Management (GxExM) effects, adaptability and stability of the new hybrids and map their suitability in the semi-arid areas, Kongwa, Kiteto and Iringa    2. Determine the nutrition status of DT maize hybrid grain vs traditionally preferred maize grain    3. Assess the performance of selected DT hybrids at farm-level to by farmers from gender-based perspective to generate data for systems analysis in the socio, economic and human condition domains | | | |
|  | | | |
| 3. Research questions | | | |
| 3.1 How is the performance of selected top 4 DT hybrids under different soil fertility management & land tillage practice practices (optimal, Fertilizer + no ridges; Optimal, Fertilizer + tied ridges) (tied ridges vs flat); optimal (Fertilizer + no ridges), Optimal (Fertilizer + tied ridges), Nitrogen stress (Flat tillage + Fertilizer; ridges + no fertilizer)? | | | |
| 3.2 What is the effect of the variation within or between plots and sites as a source of genotype x environment x management (GxExM); Effect of fertility management (fertilizer or no fertilizer) on hybrid performance; also genotype x management (farmer practice) effect on the performance of hybrids (This will be complemented by the baby trial data that will have different management practices between farmers) | | | |
| 3.3. What is the nutrition status of the grains of the new hybrids compared to common or farmer preferred hybrids? | | | |
| 3.4 How do new hybrids map out on adaptability in the semi-arid areas based on yield, weather data? | | | |
|  | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | |
| The trial will be conducted as follows:  Mother trial set up: A mother trial with 4 selected hybrids and 3 checks will be planted at 7 sites. One of the sites will be near Farmer Maile. We tried to have the site at Maile’s main farm, but space was limited therefore we secured a field nearby.  4 hybrids (main treatments) plus 3 checks (two commercial hybrids and one local variety) will be used in the trial (Table 2).  This trial will be conducted using Alpha lattice design, each treatment planted on plots, each plot consisting of five rows, 6 meters each row, at spacing of 0.25m between hills and 0.75m between rows, and the trial will have two reps.  The study has Hybrids (main factor), environment and management as secondary factors.  The following model will be used:  Yijrkm = µ+ Lj + Mm(Rr(Lj) + Bk[Mm(Rr(Lj))] + Hi + HLMijm + Ɛijrkm,, where:  Yijrkm is the trait estimated value of hybrids (H) *i* at location (L)*j* and replication (R) *r* within block (B) *k* under management practice M (m), µ is the general mean, Lj is the fixed effect of location *j,* Rr(Lj) is the fixed effect of replicate *r* within location *j*, Bk[(Mm(Rr(Lj))] is the random effect of incomplete block *k* under management practice M(m), within replicate *r* and location *j*, assumed to be normally distributed having mean zero with variance σ2B(M(RL)), Hi is the fixed effect of Hybrid *i*, HMLij is the fixed effect of Hybrid x Management Practice x location interaction and Ɛijrkm is the random residual error, assuming normal distribution with mean zero and variance σ2Ɛ.  Baby Trials: Twenty baby trials have been set up across Kongwa, Kiteto and Iringa. Farmers received seed to plant at their farms, each farmer receiving one of the hybrids planted in the mother trial. The hybrid received by the farmer will be grown under farmer management. We plan to combine the mother trial and the baby trial to generate economic, socio and human condition data. The farmers received an average of 6 kg each. Data type and collection levels are presented in the research protocol.  The mother trial is planted on alpha lattice design and this design has treatments nested in small blocks; in a rep and at each location (Block=microenvironment; rep=slightly bigger environment and Location = larger environment). This eliminates much noise from spatial variation). Each tillage practice is treated as independent, so it has all the treatments and these with different fertilizer combinations will be analyzed within that set. To compare the two sets tied ridges vs no tied ridges, the two sets will then be analyzed in a combined analysis since they have the same treatment sets. The treatments HxFertilizer, Hybridx0Fertilizer etc, for example, are arranged in factorial combinations. BLUPS generated from this analysis will go to the second model for stability analysis.  Stability Analysis. Genotype x environment x management data will be calculated using either of the following methods; Additive main effect and multiplicative interaction analysis (AMMI), Site regression (SREG), Partial least square (PLS), Stability analysis and Factorial regression using R software.  A linear regression model with interaction genotype by environment is like:  Yijk = µ + di + (1 + ßi)emjk +δijk + Ɛijk  Where, Yijk is the average phenotypic value of the ith genotype in the jth environment using management, µ is the general mean, di is the effect of the ith genotype (i=1,...,t), ej is the effect of the jth environment (j=1,...,s), 1 + ßi is the regression of Yijk in emjk, δijk is the deviation of the regression for the ith genotype in the jth environment on kth management practice, Ɛijk is the error. | | | |
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| 5. Data (with metrics) to be collected and uploaded on Dataverse | | | |

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| --- | --- | --- | --- | --- | --- |
| Domain/*Indicator* | Field/plot level metrics | Farm level metrics | Household level metrics | Community/  Landscape metrics | Measurement method |
| Productivity | | | | | |
| *Crop biomass* | Yield (kg/ha/*season*) | Yield (kg/ha/season) |  |  | Yield measurements |
| Environment | | | | | |
| *Pesticide use* | Active ingredient applied per ha |  |  |  | Agricultural survey |
| *Pest levels* | Pest abundance and severity by type |  |  |  | Traps |
| Economic | | | | | |
| *Profitability* | Net income ($/crop/ha/season) |  |  |  | Calculated based on yield |
| Social | | | | | |
| Human Condition | | | | | |
| *Nutrition* | Protein production  (g/ha)  Micronutrient  production (g/ha) | Total protein  production (g/ha)  Total micronutrient  production (g/ha) | Access to nutritious foods |  | Lookup tables |
| *Capacity to experiment* |  |  | # of new practices being tested | % of farmers  Experimenting | Focus group,  Individual survey |

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| 6. Deliverables | Means of verification | Delivery date |
| 6.1 Manuscripts:   * Manuscript on the new DT hybrids * Manuscript on value chain analysis study (2019 activity under AR support) * Manuscript on QPM (from previous research under AR support) | Publications | Sep. 2020 |
| 6.2 Superior DT hybrids suitable for farm-level production confirmed | Project progress reports, M&E reports | Sep. 2020 |
| 6.3 Data available on hybrids for analysis based on systems approach and subsequently, contribution due to improved variety to smallholder agricultural production systems improvement can be determined | Data analysis, Project reports | Sep. 2020 |
| 6.4 Profitability of top-performing hybrids determined | Gross margin analysis project report | Sep. 2020 |
| 6.5 Community participation enhanced & knowledge about best DT hybrids increased | Field day reports | Aug. 2020 |
| 6.6 Hybrids with high biomass identified as potential fodder source | Project reports | Sep. 2020 |
| 6.7 Hybrids with high nutrition value identified | Lab analysis reports | Sep. 2020 |

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| 7. How will scaling be achieved? |
| Engagement of seed companies & agro-dealers through variety release, commercialization and delivery of certified seed to local market outlets accessible by local farming communities in Kongwa, Kiteto and Iringa. With reference to sub-activity 5.2.2.1; agreements with seed companies on partnerships with signed MoUs may facilitate the rapid uptake of new hybrids by seed companies. |
|  |
| 8. How are the activities in this protocol linked to those of others? |
| To realize hybrid yield potential, good agronomic practices combined with good soil and water conservation practices are critical. This research will be conducted in treatment combinations of validated fertilizer rates (ICRAF), S&WC (Hombolo) (Sub activity 1.2.2.1), as well as utilization of information generated through ISFM (SUA). Nutrition information linking to SUA & ICRISAT research. Data generated will be available for systems analysis and scaling support. This research will also link up with ARI-Hombolo on economic analysis aspects. |
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9. Gantt chart

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|  | **2019** | | **2020** | | | | | | | | | | | |
| **Activity** | **Oct/**  **Nov** | **Dec** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **July** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Site selection |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Land preparation |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Harrowing and planting |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1st weeding |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Topdressing of trials |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2nd weeding |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Data collection |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Field days |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Harvesting |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Lab analysis |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Data analysis |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Report write-up and submission |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Manuscripts preparation (Draft) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

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| Outcome 1: Productivity, diversity, and income of crop-livestock systems in selected agro-ecologies enhanced under climate variability | | | | | | | | | | |
| a. Output 1.1 | Demand-driven, climate-smart, integrated crop-livestock research products (contextualized technologies) for improved productivity, diversified diets, and higher income piloted for specific typologies in target agro-ecologies | | | | | | | | | |
| b. Activity 1.1.1 | Assess and iteratively improve resilient crop-crop and crop-livestock integration systems | | | | | | | | | |
| c. Sub-activity 1.1.1.2 | Investigations on the medium to long term impacts of SI technologies (improved soil fertility management, improved germplasm, crop combinations, nutrient and water management) on crop productivity on multi-locational fields sites and baby trials | | | | | | | | | |
|  | | | | | | | | | | |
| d. Research team | | | | | | | | | | |
| Name | | Institution | | Roles | | | | | | |
| Regis Chikowo, Sieg Snapp | | MSU | | PIs, research conceptualization, design, implementation | | | | | | |
| Julius Manda | | IITA | | Guide on economic analysis approaches e.g. providing templates | | | | | | |
| Gundula Fischer | | IITA | | Provide appropriate methodologies for gender analysis, depending on the local context, study type | | | | | | |
| N.N. | | IITA/IFPRI | | M&E | | | | | | |
|  | | | | | | | | | | |
| e. Student(s) | | | | | | | | | | |
| Name | | Institute. | | Degree | | Start | | | End | |
| Chiwimbo Gwenambira | | MSU | | PhD Agroecology | | 2016 | | | 2020 | |
|  | | | | | | | | | | |
| f. Location(s) | | Linthipe, Golomoti, Kandeu, Nsipe, Mtubwi, Nsanama, Nyambi Extension Planning Areas (EPAs) | | | | | | | | |
|  | | | | | | | | | | |
| g. Start date | | Some sites started 2013; some November 2016 | | | | | | | | |
| h. End date | | September 2021 (Dedza/Ntcheu/Machinga) | | | | | | | | |
|  | | | | | | | | | | |
| 1. Justification | | | | | | | | | | |
| Integrating more grain legumes as intercrops or rotational system can allow farmers to achieve high and stable yields under varying rainfall, with modest fertilizer investments. This is critical for resource-poor farmers who have limited access to mineral fertilizers. In these experiments that were initiated in 2012, we investigate Soil Organic Carbon (SOC) changes over time for treatments that range from an unfertilized control, maize fertilized with NP optimally every year and integration of legumes as intercrops or rotations with maize.  To date, our interventions have resulted in increased productivity by at least 30% and diversified diets that resulted from increased legume processing into food. Two food preparation recipes based on soybean are now widely used in households. There is scope to increase productivity by a further 20% through a combination of improved agronomy and farmer training at farm scale, thus reducing yield gaps. Recently we have applied stability analysis to assess impacts of grain legume integration on maize grain yield, yield stability, nitrogen use efficiency (NUE) and ability to meet household protein requirements.  This sub-activity has anchored our action research that has resulted in over 4,000 baby farmers increasing productivity and expanding the area under SI technologies. More details on these experiments are outlined in the following publications: Smith *et al*., 2016 Agricultural Systems[[1]](#footnote-1); Snapp *et al*., 2019[[2]](#footnote-2); Chimonyo *et al*., 2019[[3]](#footnote-3). This sub-activity presents a rare opportunity to apply SI technologies on-farm for ‘medium to long term’. Thus, there is merit in continuing with these experiments, which also form the basis for the newly introduced systems analysis ‘Case Studies’ sub-activity 5.1.1.4 | | | | | | | | | | |
|  | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | |
| 2.1 To evaluate long-term effects of rotating legumes with maize at multi- location sites, and establish yield stability | | | | | | | | | | |
|  | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | |
| 3.1 What is the degree of stability of legume/maize rotations over time and across different sites? | | | | | | | | | | |
|  | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | |
| In these experiments that were initiated in 2012, we investigate SOC changes over time for treatments that range from an unfertilized control, maize fertilized with NP optimally every year and when legumes are integrated as intercrops or rotations with maize. All treatments are replicated three times. The primary data to be collected will be grain yield and biomass productivity. We will harvest on a whole plot basis, especially when farmers are involved in harvesting and participatory evaluation of the technologies. The protein and calorie production from the various technologies will be used to inform the utility of the technologies regarding the human condition domain.  The N- difference method will be used to estimate biological N2-fixation. Recently, we have applied stability analysis to assess the impact of grain legume integration on maize grain yield, yield stability, nitrogen use efficiency (NUE) and the ability to meet household protein requirements. More details on these experiments are outlined in the publications Smith *et al*., 2016[[4]](#footnote-4); Snapp *et al*., 2018[[5]](#footnote-5); Chimonyo *et al*., 2019[[6]](#footnote-6), and in the Research Protocols 2019-2020. | | | | | | | | | | |
|  | | | | | | | | | | |
| 5. Data (with metrics) to be collected and uploaded on Dataverse | | | | | | | | | | |
| Domain & *Indicator* | | | Field/plot level metrics | | Farm level metrics | | Household level metrics | | | Measurement method |
| Productivity | | | | | | | | | | |
| *Maize grain productivity* | | | Maize grain and biomass yield (kg/ha/season); | | Maize production (kg/ha | |  | | | Yield measurements |
| *Maize biomass productivity* | | | Legume grain and biomass yield (kg/ha/season | | Maize residue production (kg/ha/season) | |  | | | Yield measurements |
| *Legume productivity* | | | Soybean/groundnut grain and biomass yield (kg/ha/season); | |  | |  | | | Yield measurements |
| *Yield gap* | | | Yield gap for maize, soybean, groundnuts (kg/ha/season) | |  | |  | | | Yield measurements |
| Economic | | | | | | | | | | |
| *Profitability* | | | Net income ($/crop/ha/season); | |  | |  | | | survey |
| *Income diversification* | | |  | |  | | Number of income sources | | | survey |
| Environmental | | | | | | | | | | |
| *Soil biology* | | | Soil organic carbon (g/kg) | |  | |  | | | Laboratory testing |
| *Soil chemical quality* | | | Biological N2-fixation(kg/ha) | | Biological N2-fixation (kg/farm) | |  | | | Direct measurement |
| Human condition | | | | | | | | | | |
| Nutrition | | | Protein production (g/ha) | |  | |  | | | Lookup tables |
| *Food security* | | | Food production  (calories/ha/year) | |  | | Months of food insecurity | | | Survey |
| Social | | | | | | | | | | |
| *Gender equity* | | | Rating of technologies by gender | |  | |  | | | Participatory evaluation |
| *Equity (generally)* | | | Capacity (access to information) | |  | |  | | | Participatory evaluation |
|  | | | | | | | | | | |
| 6. Deliverables | | | | Means of verification | | | | Delivery date | | |
| 6.1 SI field trials established for each site | | | | List of field trials, host farmer names available | | | | Jan. 2020 | | |
| 6.2 Baby trials established by at least 3,000 farmers experimenting with SI technologies | | | | Farmer lists and SI technologies being implemented in baby trials | | | | Jan. 2020 | | |
| 6.3 Benefits of SI technologies evaluated across sites | | | | Productivity data files available | | | | Sep. 2020 | | |
| 6.4 At least one field day per EPA conducted | | | | Field day reports | | | | Jul. 2020 | | |
| 6.5 At least 2 farmer exchange visits conducted involving about 40 farmers | | | | Farmer exchange visits reports | | | | Aug. 2020 | | |
| 6.6 Africa RISING attends at least one DAECC-led workshop per district for SI technologies dissemination | | | | DAECC meetings and field implementation report | | | | Sep.2020 | | |
| 6.7 SANE –Africa RISING collaboration extended 2020 | | | | Field day activities reports | | | | Sep. 2020 | | |
|  | | | | | | | | | | |
| 7. How will scaling be achieved? | | | | | | | | | | |
| * Malawi extension system (District Agricultural Extension Coordinating Committees=DAECC) that has oversite on technology dissemination at district level will help disseminate technologies in Extension Planning Areas (EPAs) that are not physically reached by Africa RISING project. We involve the extension system in all field days to increase the likelihood of effective learning and dissemination through the extension system. The DAECC constitutes a network that includes district-level government extension system and NGOs operating in the district like United Purpose (UP), World Vision and CADECOM. The composition of the DAECC is dynamic. This body harmonizes agricultural technologies dissemination approaches and improves the efficiency of use/allocation of financial resources by different actors in the different EPAs. * Strengthening Agriculture and Nutrition Extension (SANE) –Africa RISING partnership renewed for 2020 to reach 10,000 farmers * Hold joint farmer field days (at least 1 per district) in partnership with DAECC | | | | | | | | | | |
|  | | | | | | | | | | |
| 8. How are the activities in this protocol linked to those of others? | | | | | | | | | | |
| The choice of crop varieties has been harmonized based on experiences and technical advice from ICRISAT. For example, groundnut varieties used in this sub-activity and the LUANAR sub-activity are based on guidance from ICRISAT breeders. Increased productivity of grain legumes based on this sub-activity is directly linked to nutrition studies, sub-activity 3.2.2.3. | | | | | | | | | | |

9. Gantt chart

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| **Activity** | **2019** | | | **2020** | | | | | | | |
| **Oct.** | **Nov.** | **Nov - Dec** | **Jan.** | **Feb-Mar** | **Apr.** | **May** | **Jun.** | **Jul.** | **Aug.** | **Sept.** |
| Procurement of inputs |  |  |  |  |  |  |  |  |  |  |  |
| IITA –MSU contract/inputs distribution |  |  |  |  |  |  |  |  |  |  |  |
| MSU/partners contracting |  |  |  |  |  |  |  |  |  |  |  |
| MSc students engaged/Land preparation/goats’ acquisition |  |  |  |  |  |  |  |  |  |  |  |
| Pre-establishment country meeting to ensure systems harmonization (about 22 Nov) |  |  |  |  |  |  |  |  |  |  |  |
| Establishment of action research/soil sampling |  |  |  |  |  |  |  |  |  |  |  |
| Field assessments/data collection (crop/livestock) |  |  |  |  |  |  |  |  |  |  |  |
| Farmer/farms profiling for case studies |  |  |  |  |  |  |  |  |  |  |  |
| Yield data collection on cases study farms/harvesting |  |  |  |  |  |  |  |  |  |  |  |
| Fields days (vegetative stage/maturity stage) |  |  |  |  |  |  |  |  |  |  |  |
| Host project external evaluation team/field tour |  |  |  |  |  |  |  |  |  |  |  |
| Yield cuts survey/general harvesting of trials |  |  |  |  |  |  |  |  |  |  |  |
| Post-harvest workshops /feedback meetings |  |  |  |  |  |  |  |  |  |  |  |
| Pre-report & planning country meeting (about 20 July 2020) |  |  |  |  |  |  |  |  |  |  |  |
| Report writing/publications |  |  |  |  |  |  |  |  |  |  |  |
| Dataverse data upload |  |  |  |  |  |  |  |  |  |  |  |

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| Outcome 1: Productivity, diversity, and income of crop-livestock systems in selected agro-ecologies enhanced under climate variability. | | | | | | | | | | | | |
| a. Output 1 | | | Demand-driven, climate-smart, integrated crop-livestock research products (contextualized technologies) for improved productivity, diversified diets, and higher income piloted for specific typologies in target agro-ecologies | | | | | | | | | |
| b. Activity 1.1.1 | | | Assess and iteratively improve resilient crop-crop and crop-livestock integration systems | | | | | | | | | |
| c. Sub-activity 1.1.1.3 | | | Determining the productivity of groundnut as a function of seed generation x variety x density interactions in two contrasting agro-ecologies, and rotational benefits to maize | | | | | | | | | |
|  | | | | | | | | | | | | |
| d. Research team | | | | | | | | | | | | |
| Name | | Institution | | | | | | Role | | | | |
| Wezi Mhango | | LUANAR | | | | | | PI, research design and implementation, technology evaluation reporting | | | | |
| Regis Chikowo, Sieg Snapp | | MSU | | | | | | Co-PIs, research conceptualization, design, implementation | | | | |
| DADOs | | Dedza and Machinga Agriculture Extension Offices | | | | | | Convening district-wide field days and farmer and extension exchange visits | | | | |
| N.N. | | IFPRI | | | | | | M&E support | | | | |
|  | | | | | | | | | | | | |
| d. Student(s) | | | | | | | | | | | | |
| Name | | Institute | | | Degree | | | | | Start | | End |
| Isaac Maviko | | LUANAR | | | MSc Agronomy | | | | | Nov. 2019 | | Nov. 2021 |
|  | | | | | | | | | | | | |
| f. Location(s) | | Linthipe (Dedza) and Ntubwi (Machinga) Extension Planning Areas (EPAs) | | | | | | | | | | |
|  | | | | | | | | | | | | |
| g. Start date | | 2017 | | | | | | | | | | |
| h. End date | | September 2020 | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 1. Justification | | | | | | | | | | | | |
| Groundnuts (*Arachis hypogaea*) is an important grain legume crop in Malawi. It is widely grown in Malawi for food, income, and livestock feed. It provides approximately 25% of the agricultural income. Groundnut fixes nitrogen through biological nitrogen fixation (BNF) and this improves soil health and productivity of cereal-based systems. Despite these benefits, grain yields are still low averaging about 800 kg/ha, less than one third the potential yield of 2,500 kg/ha. The large yield gap is due to several factors such as non-availability of seed of improved varieties, poor seed quality, inappropriate crop management practices, pests and diseases (ICRISAT, 2013[[7]](#footnote-7)). We have demonstrated that double-row planting results in both larger groundnut grain yields and biomass, in many cases increases are between 40 and 70%. This is significant and important in an environment where farms are small (generally <1 ha). Increased groundnut and soybean production will have ripple effects on nutrition outcomes if this technology is adopted at scale.  Farmer decision-making is largely driven by meeting household food security which is linked to maize (calories). Larger legume biomass productivity is known to result in better N cycling and improved maize crop grown in sequence. In this sub-activity, we will determine the effect of season quality by repeating the experiment over another year. We will also determine the nitrogen residual effects on the maize grown in rotation following single or double row-groundnut. | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | | | |
| 2.1 To assess the effect of seed generation on yield and yield components of groundnut | | | | | | | | | | | | |
| 2.2 To assess the effect of planting density on yield and yield components of groundnut | | | | | | | | | | | | |
| 2.3 To assess the effect of seed generation and plant density on biological nitrogen fixation by groundnut | | | | | | | | | | | | |
| 2.4 To evaluate maize yield following groundnut systems | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | | | |
| 3.1 How does the productivity of groundnut and its leguminous residual effects depend on seed generation x variety x density interactions? | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | | | |
| The experiment has been implemented since 2017/18 and 2018/2019 cropping season with goals 1) repeating the experiment during several cropping seasons to investigate the effects of crop density and seed generation, and 2) getting the residual effects on maize grown in sequence. Some sites that have completed the legume-maize sequence will be discontinued. There are two sites from the 2018/2019 cropping season that will be in the maize phase during the 2019/20 cropping season to test groundnut rotational effects. Two new sites will be in the legume phase during the 2019/20 cropping season so we can better understand how season type (which is a random variable) interacts with seed quality and plant density. There will be two researcher-designed farmer-managed groundnut on-farm trials to be conducted in two contrasting ecological zones of Dedza district (Linthipe EPA) and Machinga district (Mtubwi EPA). Linthipe EPA is on high altitude, receives more rainfall above 1,200 mm per annum while Mtubwi EPA lies in the low altitude area, with high average temperatures and evapotranspiration, and receives less rainfall around 600 mm. | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 5. Data (with metrics) to be collected and uploaded on Dataverse | | | | | | | | | | | | |
| Domain & *Indicator* | Field/plot level metrics | | | Farm level metrics | | Household level metrics | | | Community /landscape metrics | | | Measurement method |
| Productivity | | | | | | | | | | | | |
| *Maize grain productivity* | Maize grain and biomass yield (kg/ha/season) | | | Maize production (kg/ha | |  | | |  | | | Yield measurements |
| *Legume productivity* | Groundnut grain and biomass yield (kg/ha/season) | | |  | |  | | |  | | | Yield measurements |
| *Yield gap* | Yield gap for groundnuts (kg/ha/season) | | |  | |  | | |  | | | Yield measurements |
| Economic | | | | | | | | | | | | |
| *Profitability* | Net income ($/crop/ha/season);  Gross margin | | |  | |  | | |  | | | Survey |
| *Labor requirement* | Farmer rating of labor | | | Farmer rating of labor | |  | | |  | | | Farmer evaluation |
| Environmental | | | | | | | | | | | | |
| *Soil biology* | Active soil organic carbon (g/kg) | | |  | |  | | |  | | | Laboratory testing |
| *Soil chemical quality* | Biological N2-fixation by groundnut (kg/ha) | | | Biological N2-fixation (kg/farm) | |  | | |  | | | Direct measurement |
| Human condition | | | | | | | | | | | | |
| *Nutrition* | Protein production (g/ha) | | |  | |  | | |  | | | Lookup tables |
| *Food safety* | Mycotoxins (mg/kg) | | |  | |  | | |  | | | Laboratory testing |
| Social |  | | |  | |  | | |  | | |  |
| *Gender equity* | Rating of technologies by gender | | |  | |  | | |  | | | Participatory evaluation |
| *Equity (generally)* | Capacity (access to information) | | |  | |  | | |  | | | Participatory evaluation |
|  | | | | | | | | | | | | |
| 6. Deliverables | | | | | | | Means of verification | | | | Delivery date | |
| 6.1 SI field trials established for each site | | | | | | | List of field trials, host farmer names available | | | | Jan. 2020 | |
| 6.2 Benefits of SI technologies evaluated across sites | | | | | | | Productivity data files available; economic analysis and profitability evaluation report | | | | Sep. 2020 | |
| 6.3 At least one field day per EPA conducted | | | | | | | Field day reports | | | | Aug. 2020 | |
| 6.4 At least one farmer feedback workshop conducted in each EPA | | | | | | | Farmer feedback workshop reports | | | | Aug. 2020 | |
| 6.5 District level dissemination of improved groundnut germplasm x density for improved productivity (at least 4,000 farmers receive information) | | | | | | | 4,000 Leaflets of improved groundnut agronomy produced and distributed during field days in all research sites | | | | Sep. 2020 | |
|  | | | | | | | | | | | | |
| 7. How will scaling be achieved? | | | | | | | | | | | | |
| Improved groundnut agronomy will be scaled through the Agricultural Extension system and DAECC. The National Smallholder Farmers’ Association of Malawi (ASFAM) is an important stakeholder for scaling improved groundnut production of technologies as it is involved in both production and value addition. We will engage these stakeholders at DAECC meetings and provide them with evidence on best practices. | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 8. How are the activities in this protocol linked to those of others? | | | | | | | | | | | | |
| Other protocols being implemented by the MSU team (e.g. Sub-activity 1.1.1.2) and related baby trials use improved seed but the interaction with plant density from this sub-activity adds value to these initiatives. | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 9. Gantt chart: see 1.1.1.2 | | | | | | | | | | | | |

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| Outcome 1: Productivity, diversity, and income of crop-livestock systems in selected agro-ecologies enhanced under climate variability | | | | | | | | | | | | |
| a. Output 1.1 | | Demand-driven, climate-smart, integrated crop-livestock research products (contextualized technologies) for improved productivity, diversified diets, and higher income piloted for specific typologies in target agro-ecologies | | | | | | | | | | |
| b. Activity 1.1.1 | | Assess and iteratively improve resilient crop-crop and crop-livestock integration systems | | | | | | | | | | |
| c. Sub-activity 1.1.1.4 | | Exploring productivity of goats under controlled breeding and feeding regimes among young breeding female goats in crop-livestock systems in Malawi | | | | | | | | | | |
|  | | | | | | | | | | | | |
| d. Research team | | | | | | | | | | | | |
| Name | | | Institution | | | Role | | | | | | |
| Fanny Chigwa | | | LUANAR | | | PIs, research conceptualization, design, implementation | | | | | | |
| Julius Manda | | | IITA | | | Economics analysis support | | | | | | |
| IFPRI | | | IFPRI | | | M&E | | | | | | |
|  | | | | | | | | | | | | |
| e. Student | | | | | | | | | | | | |
| Name | | | Institute | | | | Degree | | | Start | | End |
| Merchious Mpinganjira | | | LUANAR | | | | MSc in Animal Science | | | 2019 | | Oct. 2020 |
|  | | | | | | | | | | | | |
| f. Location | | | Mtubwi, Extension Planning Area (EPA) | | | | | | | | | |
|  | | | | | | | | | | | | |
| g. Start date | | | July 2019 | | | | | | | | | |
|  | | | | | | | | | | | | |
| h. End date | | | September 2021 | | | | | | | | | |
|  | | | | | | | | | | | | |
| 1. Justification | | | | | | | | | | | | |
| The work on community goat feeding regimes that was proposed during 2018/2019 was found to be too difficult to implement as some of the challenges that emerged were not anticipated. The work was therefore abandoned before most of the research funds had been used. As a result, this new proposed sub-activity with a focus on breeding and improved goat feeding will use the funds allocated during 2018/2019 work plan. The Livestock PI has produced this sub-activity with a different focus from 2018/19 workplans. Goat breeding and feeding systems are a challenge among smallholder farmers in Malawi. Farmers rearing goats in Mtubwi are facing huge challenges related to high rates of abortion among yearlings, goats kidding for the first time. Abortions in young breeding females may be caused by early breeding under uncontrolled breeding, feed shortage, and disease prevalence. | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | | | |
| 2.1 To explore the tradeoffs of using different breeding system | | | | | | | | | | | | |
| 2.2 To evaluate the effect of different breeding system on reproductive performance | | | | | | | | | | | | |
| 2.3 To evaluate the effect of different dietary treatments based on baobab and Sunflower cake-based rations in total mixed rations with crop residues on reproductive performance of female local goats | | | | | | | | | | | | |
| 2.4 To evaluate the profitability of raising goats under different breeding systems | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | | | |
| 3.1 What is the integrative effect of improved breeding and dietary treatments on the reproductive performance of female local goats? | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | | | |
| On-farm. The study will be laid in a two by two factorial design. The study will use two breeding systems of controlled and uncontrolled. Female goats will be with male goats all the time. Under controlled breeding, the male goat will have an apron to ensure it does not mate females below the required breeding weight. All male goats will be of the same breed, age and scrotal circumference and will have a similar number of females. Each breeding system will have goats on either sunflower or a baobab seed cake-based ration (see table below). On-farm, each treatment will be hosted by two farmers, for a total of 8 farmers. Each farmer will feed four females and one buck. A total of 40 goats, 32 female and 8 males will be used in this study.  There will be an on-station trial at Bunda, where each of the four diets will have 10 female goats and one buck. Each goat will be individually fed for proper measurement of feed intake.   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Treatment layout | | | | | | | | | | | | | | | Breeding system | Controlled breeding | | | | | | Uncontrolled Breeding | | | | | | | | 16% CP | Baobab | | | Sunflower | | | Baobab | | | Sunflower | | | | Replicate goats & farmers | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |   Data on weight gains will also be used to evaluate the profitability of raising goats under different breeding systems. | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 5. Data (with metrics) to be collected and uploaded on Dataverse | | | | | | | | | | | | |
| Domain & *Indicator* | Field/plot level metrics | | | Farm level metrics | | | | Household level metrics | Community /landscape metrics | | | Measurement method |
| Productivity | | | | | | | | | | | | |
| *Animal productivity* |  | | |  | | | | Animal product per household (product/household/yr) |  | | | Production measurement |
| *Variability of production* |  | | |  | | | | Rating of production risk |  | | | Farmer evaluation |
| Economic | | | | | | | | | | | | |
| *Profitability* | Net income ($/feeding system/flock/ season) | | |  | | | |  |  | | | Participatory evaluation |
| *Income diversification* |  | | |  | | | | Number of income sources |  | | | Survey |
| Human condition | | | | | | | | | | | | |
| *Nutrition* | Protein production (g/day) | | |  | | | |  |  | | | Lookup tables |
| *Capacity to experiment* |  | | |  | | | | Number of new practices being tested |  | | | Individual survey |
| Social | | | | | | | | | | | | |
| *Equity* | Rating of technologies by gender | | |  | | | |  |  | | | Participatory evaluation |
| *Gender equity* |  | | |  | | | | Livestock ownership by gender |  | | | Focus group discussions |
|  | | | | | | | | | | | | |
| 6. Deliverables | | | | | Means of verification | | | | | | Delivery date | |
| 6.1 Feeding trial established for Mtubwi and at LUANAR | | | | | Host farmer names available in non-publishable project reports | | | | | | Jan. 2020 | |
| 6.2 Benefits of SI technologies evaluated in Mtubwi | | | | | Economic benefits evaluated; breeding rate evaluated and presented in project reports | | | | | | Sep. 2020 | |
| 6.3 At least one field day per site conducted, DAECC exposed to promising technologies for possible scaling | | | | | Field day reports | | | | | | Jul. 2020 | |
|  | | | | | | | | | | | | |
| 7. How will scaling be achieved? | | | | | | | | | | | | |
| The Malawi extension system at district level (the District Agricultural Extension Coordinating Committees – DAECC) is a primary stakeholder for disseminating improved goat breeding technologies to other EPAs and districts. Hold a field day in the community and expose the technology to more farmers and stakeholders. | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 8. How are the activities in this protocol linked to those of others? | | | | | | | | | | | | |
| This is a standalone study with no clear linkages with crop/soil based sub-activities in this work plan. However, this sub-activity contributes to diversified income sources. | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 9. Gantt chart: see sub-activity 1.1.1.2 | | | | | | | | | | | | |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Outcome 1: Productivity, diversity, and income of crop-livestock systems in selected agro-ecologies enhanced under climate variability | | | | | | | | | | | | | |
| a. Output 1.1 | | | | Demand-driven, climate-smart, integrated crop-livestock research products (contextualized technologies) for improved productivity, diversified diets, and higher income piloted for specific typologies in target agro-ecologies | | | | | | | | | |
| b. Activity 1.1.1 | | | | Assess and iteratively improve resilient crop-crop and crop-livestock integration systems | | | | | | | | | |
| c. Sub-Activity 1.1.1.5 | | | | Determining the productivity and resilience benefits of Gliricidia-based cropping systems | | | | | | | | | |
|  | | | | | | | | | | | | | |
| d. Research team | | | | | | | | | | | | | |
| Name | | | Institution | | Role | | | | | | | | |
| Anthony Kimaro | | | ICRAF | | PI, Leading biophysical (tree-crop interactions) studies | | | | | | | | |
| Emmanuel Temu | | | ICRAF | | Leading the socio-economic analyses of tested technologies | | | | | | | | |
| Julius Manda | | | IITA | | Contributing to economic analyses of agroforestry technologies | | | | | | | | |
| Amos Ngwira | | | ICRISAT | | Modelling crops performance and sustainability of the Gliricidia-based cropping system | | | | | | | | |
| IFPRI | | | IFPRI | | Monitoring of the research activities to ensure compliance with the FtF monitoring system | | | | | | | | |
|  | | | | | | | | | | | | | |
| e. Students | | | | | | | | | | | | | |
| Name | | | Institute | | | | Degree | | | | | Start | End |
| Leah Renwick | | | UC Davis | | | | MSc (Drought resistance of maize in Agroforestry) | | | | | 2019 | 2020 |
| Hafner | | | Humboldt University | | | | Ph.D. (Enhancing Food and Energy Security via Agroforestry) | | | | | 2018 | 2020 |
|  | | | | | | | | | | | | | |
| f. Locations: | Manyusi, Mlali and Moleti villages in Kongwa District | | | | | | | | | | | | |
|  | | | | | | | | | | | | | |
| g. Start date | October 2015 | | | | | | | | | | | | |
|  | | | | | | | | | | | | | |
| h. End date | September 2021 | | | | | | | | | | | | |
|  | | | | | | | | | | | | | |
| 1. Justification | | | | | | | | | | | | | |
| Diversification of cropping systems through legume intercropping has the potential to increase agroecosystem resilience and adaptive capacity of farmers through efficient use of growth resources and diversification of production options and income sources. However, there is insufficient evidence for the long-term adaptation benefits of agroforestry systems and the underlying mechanisms in semiarid areas. Accordingly, ICRAF and partners have been testing (under research) and validating (in baby trials) the efficacy of intercropping maize with *Gliricidia sepium* (Jaqua) and/or pigeon pea (*Cajanus cajan* L. Millsp) on soil nutrient and water dynamics and crop productivity as well as assessing the sustainability of this technology using the SIAF framework. The research was conducted in one experimental site at Manyusi since in 2015 and 71 farmer-managed demonstration plots since 2018. Unlike research plots, the assessment of crop yields in farmer-managed intercropping plots did not run right from the beginning because of the delayed establishment of trees in intercropped farmer plots due to poor management and stress such that it took time to get enough samples of farmers to validate the technology. Hence previous workplans focused on the preliminary assessment of growth and wood of *G. sepium* in various agroforestry-based technologies (Intercropping, contours and woodlot) established (Kimaro *et al*., 2019[[8]](#footnote-8)). Also, earlier research in the experimental plots focused on assessing initial site conditions and crop yields, but the assessment of the intercropping on resource use efficiency (fertilizer and rain) was introduced in 2017 (for fertilizer) and 2019 (for drought resistance) when the established trees can be expected to impact these variables. The split-plot and split-split-plot designs were used to introduce these treatments in the on-going research trial at Manyusi as detailed in the research protocol. The timing of this assessment is in line with the observation from previous studies which suggest that at least 3-5 growing seasons of intercropping *G. sepium* are needed to improve soil properties and resource (nutrient and water) use efficiency to levels that can influence crop production and agro-ecosystem resilience (Thierfelder *et al*., 2013[[9]](#footnote-9); Kimaro *et al*. 2016[[10]](#footnote-10)).  Characterization of soils in the experimental site indicated very low levels of soil nutrients (e.g. total N=0.032%) and organic matter (0.57%), suggesting that legume intercropping over time holds promise to improve soil fertility and land productivity through nutrient replenishment and organic matter buildup. Also, maize grain yield across the four seasons (2015-2019) was 5% higher in Gliricidia- or pigeon pea-based intercropping treatments compared to maize monoculture. As expected, there were seasonal variations, but this general trend reflects improved land productivity under intercropping. Soil fertility data will be collected during the 2020 season to assess changes in soil nutrients and other variables (bulk density and organic matter) which may explain the mechanisms through which intercropping can improve land productivity and resource use efficiency. A follow-up study of modelling soils and crops data from previous and the current workplans will also contribute to understanding the long-term dynamics of resource availability and intercropping options on the sustainability of tested intercropping technologies. Preliminary analysis of the economic benefits of intercropping was conducted based on yields data from the research experiment at Manyusi for the 2015 and 2016 cropping seasons ([Kimaro](https://cgspace.cgiar.org/bitstream/handle/10568/80570/kimaro.pdf?sequence=5&isAllowed=y) *[et al](https://cgspace.cgiar.org/bitstream/handle/10568/80570/kimaro.pdf?sequence=5&isAllowed=y)*[., 2018](https://cgspace.cgiar.org/bitstream/handle/10568/80570/kimaro.pdf?sequence=5&isAllowed=y)). The results showed a gross margin increase of 4- and 5-folds in pigeon pea and Gliricidia-pigeon pea intercropping treatments, respectively. Economic analysis of these technologies for the 2019 season is still going on but most data on the social and human condition variables, which mainly comes from farmers hosting demonstration plots, could not be collected due to high crop failure in farmer-managed plots. Apart from finalizing biophysical data collection on this site, the focus in the 2020 workplan will be to collect data on social, economic and human condition domains to allow for comprehensive analysis of the sustainability of Gliricidia-based intercropping technologies using the SIAF manual (Musumba *et al.*, 2017[[11]](#footnote-11)). This focus is in line with the recommendations of the pre-planning country meeting for Tanzania and the data gaps presented by Dr Lieven Claessens during the review and planning meeting in September 2019. This data gap was also noted during the pre-implementation meeting in Kongwa where the need for more biophysical data to inform the system research led by Dr Lieven Claessens and Dr Job Kihara (ISFM) was also noted. ICRAF has already shared data that is available for this work and additional data (e.g Economics, Social and Human Condition Domains) which need to be collected in 2020 to full fill our obligations in the ISFM sub-activity 2.2.1.3.  Over the last five years (2014-2019), farmers have been establishing various agroforestry technologies within and outside Africa RISING sites. These include contours, Gliricidia-maize intercropping, boundary planting and woodlots. These technologies were integrated with the agricultural landscape to provide multiple benefits to farmers like land rehabilitation and improved crop production, fodder for livestock nutrition, and on-farm wood supply to improve household energy security and reduce the workload on firewood collection. Farmers adopt technologies for various reasons including the benefits directly derived from the technology, social status derived from interacting with outsiders and in anticipation of benefits from project personnel (German *et al*., 2006[[12]](#footnote-12)). It is, therefore, necessary to assess the adoption process of agroforestry technologies promoted to understand the drivers of adoption or dis-adoption in the project and scaling sites, benefits and/or challenges farmers have experienced, how farmers modify the technology demonstrated to them on-farm to fit based on SIAF domains evaluation, what social network including gender dimensions and market information are necessary for the access and success of the technology, and which impacts the technology has on livelihoods, environment or other components of the farming system. Understanding this kind of information can help researchers in modifying interventions or delivery approaches to be more relevant to the scaling domain ([Coe *et al.*, 2014](https://www.sciencedirect.com/science/article/pii/S1877343513001437)) and in planning future scaling operations (German *et al*., 2006[[13]](#footnote-13)). [Coe *et al.* (2014](https://www.sciencedirect.com/science/article/pii/S1877343513001437)) present a framework for tracking this information so that experience captured during the scaling operation can be used to modify promising interventions to best fit the scaling domain and hence minimizing uncertainty and risk around the adoption process. This study will be conducted as a component of the farmer-managed demonstration trial, but the survey will involve farmers and partners in the project (Africa RISING sites) and scaling sites of Ngumbi and Kitete Mzindani villages as well as villages under the LEAD foundation-TARI Hombolo collaboration where farmers have shown interest to take up soil and water conservation technologies with fodder trees. | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | | | | |
| 2.1 To assess crop yield, resource use efficiency and resilience effects of G. sepium and pigeon pea intercropping in semi-arid areas | | | | | | | | | | | | | |
| 2.2 To evaluate the impact of legume intercropping on the economics, social and human condition SI domains to quantify the benefits of the technology and fill the data gaps for the assessment of technology sustainability using the SIAF manual (<https://cgspace.cgiar.org/handle/10568/90523>) | | | | | | | | | | | | | |
| 2.3 to analyze the process of adoption and the impact of agroforestry technologies on farmers within and outside Africa RISING sites to inform future scaling operations | | | | | | | | | | | | | |
| 2.4 to assess changes in the soil resource base, resource use efficiencies, productivity and sustainability of G. sepium-based intercropping systems using the APSIM model. | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | | | | |
| Experiment design, implementation and data analysis:  This sub-activity comprises one research experiment and 19 farmer-managed (demonstrations) trials to collect final biophysical data, surveys of agroforestry practitioners to fill the data gap for the SIAF domains (mainly economics, social and human condition) and the assessment of adoption or dis-adoption of agroforestry technologies to inform scaling operations (please see section 1 of the attached protocol for details). The biophysical research is on-going and it will adopt a split-split plot experiment laid out in a randomized complete block design with three replications to assess the effects of intercropping options (5-levels), N & P fertilizers (with and without), Drought (with and without rainout shelters) on crops yields (maize and pigeon pea) and soil moisture and nutrient dynamics, resource (water and nutrient) use efficiency and socio-economic impacts as detailed in the attached protocol. Farmer-managed trials have been established using the randomized complete block design to allow statistical analyses of data (e.g. crop yield and gross margin) from demonstration plots. Agroforestry practitioners to be interviewed will be derived from the samples of farmer hosting demonstrations in Africa RISING sites and farmers in scaling sites listed earlier. | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | |
| 5. Data to be collected and uploaded on Dataverse | | | | | | | | | | | | | |
| Domain & *Indicator* | | Field/plot level metrics | | | | Farm level metrics | | | Household level metrics | Community/landscape metrics | Measurement method (details in research protocol) | | |
| Productivity | | | | | | | | | | | | | |
| *Crop productivity* | | Yield (kg/ha/season) | | | |  | | |  |  | Yield measurement | | |
| *Biomass productivity* | | Yield (kg/ha/season) | | | |  | | |  |  | Yield measurement | | |
| *Input use efficiency* | | Yield/input | | | |  | | |  |  | Productivity measurement | | |
| Environment | | | | | | | | | | | | | |
| *Fuel availability* | | Biomass (t/ha) | | | |  | | | No of energy security months |  | Biomass measurement, household survey | | |
| *Soil biology* | | Labile carbon (g/kg) | | | |  | | |  |  | Soil test | | |
| *Soil chemical*  *Quality* | | Soil pH, Soil nutrient levels (g/kg) and EC cmol/kg | | | |  | | |  |  | Soil test | | |
| *Soil physical*  *Quality* | | MC (%); Bulky density (g/cm3) | | | |  | | |  |  | Soil test | | |
| Economic | | | | | | | | | | | | | |
| *Profitability* | | Gross margin (USD/ha) | | | |  | | |  |  | Participatory evaluation | | |
| *Returns to land* | | Returns (USD/ha) | | | |  | | |  |  | Participatory evaluation | | |
| *Labor requirement* | | Labor requirement (hrs/ha) | | | |  | | |  |  | Participatory evaluation | | |
| Social | | | | | | | | | | | | | |
| *Gender equity* | |  | | | |  | | |  | Rating of technologies by gender | Participatory evaluation | | |
| *Equity* | |  | | | |  | | |  | Rating of technologies by group | Participatory rating | | |
| Human conditions | | | | | | | | | | | | | |
| *Nutrition* | | Protein production (g/ha) | | | |  | | |  |  | Conversion using food nutrient composition tables (Lookup tables) | | |
| *Food security* | | Food production (calories/ha) | | | |  | | |  | Rating of food security | Lookup tables and rating by farmers | | |
|  | | | | | | | | | | | | | |
| 6. Deliverables | | | | | | | | Means of verification | | | | Delivery date | |
| 6.1 Data and manuscript on the resource use efficiency (nutrients and water) and resilience of *G. sepium* intercropping | | | | | | | | Technical reports, data files available uploaded on Dataverse and manuscript submitted to the journal | | | | Sep. 2020 | |
| 6.2 Data on the socio-economic, gender, food security and nutrition impact of G. sepium intercropping and a draft manuscript on economic analysis of agroforestry technologies | | | | | | | | Technical report, data files uploaded on Dataverse and a draft manuscript | | | | Sep. 2020 | |
| 6.3 Profitability of Gliricidia intercropping experiment at Manyusi | | | | | | | | Draft manuscript (with Ph.D. student) | | | | Sep. 2020 | |
| 6.4 Data on the adoption process and impacts of agroforestry technologies within and outside Africa RISING sites. | | | | | | | | Technical report and data files uploaded on Dataverse | | | | Sep. 2020 | |
| 6.5 Data and draft manuscript on the modelling of long-term sustainability of G. *sepium* intercropping using APSIM (ICRISAT-Amos) | | | | | | | | Technical report, data files uploaded on Dataverse and a draft manuscript | | | | Sep. 2020 | |
| 6.6 MoU with Mikumi National Park for scaling of agroforestry technologies | | | | | | | | Technical report and signed MoU | | | | Aug. 2020 | |
| 6.7 At least 20,000 tree seedlings delivered for planting in collaboration with extension officers and partners in targeted sites | | | | | | | | Register of recipients of seedlings number of seedlings received | | | | Apr. 2020 | |
|  | | | | | | | | | | | | | |
| 7. How will scaling be achieved? | | | | | | | | | | | | | |
| ICRAF will develop a partnership agreement with Mikumi National Park and collaborate with Extension officers and DAICOs to deliver at least 20,000 tree seedlings for the uptake of scaling of agroforestry by farmers in non-Africa RISING sites in Kongwa (Ngumbi village and villages under the LEAD foundation-TARI Hombolo collaborations) and Kilosa (Kitete Msindazi village). | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | |
| 8. How are the activities in this protocol linked to those of others? | | | | | | | | | | | | | |
| This sub-activity activity is directly linked to the following sub-activities:   * Sub-activity 2.2.1.3: Evaluating potential contributions of integrated soil fertility management around the five SIAF domains with emphasis on Africa RISING interventions in Tanzania: Soil fertility and Economics data to be generated in 2020 will contribute to this system wide ISFM activity. Also, data on crop and biomass yields for previous seasons is available for this sub-activity. * Sub-activity 5.1.2.1: Apply APSIM crop simulation model to assess changes in resource use efficiencies, productivity and profitability of the different cropping systems in Kongwa, Kiteto and Iringa in Tanzania: ICRISAT-Amos; This sub-activity will make use of crop and soil data from Gliricidia-based intercropping experiment to model crop performance in response to resource availability and intercropping options under semiarid conditions in Kongwa. | | | | | | | | | | | | | |

9. Gantt chart

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **S/No** | **Description of Activity** | **Nov** | **Dec** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sept** |
| 1 | Site preparations and re-establishment of trials |  |  |  |  |  |  |  |  |  |  |  |
| 4 | Crop management (weeding, fertilizer, disease control) |  |  |  |  |  |  |  |  |  |  |  |
| 5 | Data collection for APSIM modelling by ICRISAT |  |  |  |  |  |  |  |  |  |  |  |
| 6 | Collection of data for social, economic and human condition domains |  |  |  |  |  |  |  |  |  |  |  |
| 7 | Rainout shelter re-installation at Manyusi |  |  |  |  |  |  |  |  |  |  |  |
| 8 | Biophysical data collection (maize grain and wood yield) |  |  |  |  |  |  |  |  |  |  |  |
| 9 | Attend farmer field day and Nane-nane exhibition |  |  |  |  |  |  |  |  |  |  |  |
| 10 | Collect pigeonpea data (grain & wood) |  |  |  |  |  |  |  |  |  |  |  |
| 11 | Laboratory analysis of soil and plant samples |  |  |  |  |  |  |  |  |  |  |  |
| 12 | Data processing, analysis and archiving |  |  |  |  |  |  |  |  |  |  |  |
| 13 | Writing reports and manuscripts |  |  |  |  |  |  |  |  |  |  |  |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Outcome 1: Productivity, diversity, and income of crop-livestock systems in selected agro-ecologies enhanced under climate variability | | | | | | | | | | |
| a. Output 1.1 | | | Demand-driven, climate-smart, integrated crop-livestock research products (contextualized technologies) for improved productivity, diversified diets, and higher income piloted for specific typologies in target agro-ecologies | | | | | | | |
| b. Activity 1.1.1 | | | Assess and iteratively improve resilient crop-crop and crop-livestock integration systems | | | | | | | |
| c. Sub-Activity 1.1.1.6 | | | Assess the yield, economic and BNF benefits of innovative approaches addressing the pigeon pea and common bean productivity within maize-based cropping system and variable weather | | | | | | | |
|  | | | | | | | | | | |
| d. Research team | | | | | | | | | | |
| Name | | | | Institution | | Role | | | | |
| Job Kihara | | | | CIAT | | PI | | | | |
| Ben Lukuyu/ Leonard Marwa | | | | ILRI/TALIRI | | Assessing quantity of stripping and toppings as livestock feed. | | | | |
| Gundula Fischer | | | | IITA | | Social domain including focus group discussions to understand dynamics at household level due to technologies. | | | | |
| District staff | | | | MoA | | Organize field days and supervise field operations by farmers. | | | | |
| N.N. | | | | ESA M&E Officer & Data Manager | | To provide support in monitoring of the research activities to ensure compliance with the FtF monitoring system including periodically assisting in data collection (both FtF and Custom indicators data) with critical gender perspective and uploading into the FtF system. | | | | |
|  | | | | | | | | | | |
| e. Student(s): NIL | | | | | | | | | | |
|  | | | | | | | | | | |
| f. Locations | | Seloto, Sabilo, Orngadida, Babati District | | | | | | | | |
|  | | | | | | | | | | |
| g. Start date | | |  | | --- | | Jan 2017 | | | | | | | | | |
|  | | | | | | | | | | |
| h. End date | | Nov 2020 | | | | | | | | |
|  | | | | | | | | | | |
| 1. Justification | | | | | | | | | | |
| In general, in Babati, research work by Africa RISING has developed practices that increase the productivity of maize. However, the legume (both beans and pigeon pea) remain of low productivity. To maximize the productivity and profitability of the system, increasing legume productivity is important. This can be achieved through various technologies that increase light access to the legume. The CIMMYT tested and proved maize varieties, such as Meru 513, that has vertical architecture could also lead to increased yield of intercropped legume through reduced light interception by the maize canopy. Complementary practices like maize topping, stripping of lower leaves and planting maize 2 rows closer to each other (spacing of 50 cm) leaving a large space before the next 2 maize rows also increase light penetration, creating favorable conditions for intercropped legumes in a doubled-up system like the one successfully tested in Malawi. The cropping systems have been evaluated for one season only. The study was designed for two seasons, so we need to run it in 2019/2020 as well. | | | | | | | | | | |
|  | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | |
| 2.1 Assessing the effects of different crop spatial configurations on the productivity of pigeon pea and beans within in 3 eco-zones of Babati, Tanzania | | | | | | | | | | |
| 2.2 To determine the nitrogen fixation within the maize-legume systems in 3 eco-zones in Babati | | | | | | | | | | |
|  | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | |
| 3.1 What are the effects of different crop spatial configurations on the productivity of pigeon pea and beans in 3 eco-zones of Babati, Tanzania | | | | | | | | | | |
| 3.2 To what extent does the legume integration approach (spatial set-up) contribute to nitrogen fixation within the maize-legume systems in 3 eco-zones of Babati | | | | | | | | | | |
|  | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | |
| Experiment design, implementation and data analysis:  The experiment is laid out as a randomized complete block design with 7 maize-legume intercrop treatments. In each field, each treatment is replicated 3 times. Treatment plot sizes are 7m x 5m. The net plot used for measurements of grain and biomass will leave out 1 m from each side of the plot to reduce border effects. Except for one treatment with a 50 x 90 cm maize spacing, two maize seeds will be planted at a spacing of 25 × 75 cm, and later thinned to one, to attain a plant population of 53,333 plants per hectare. Pigeon pea and beans are planted to attain similar densities across plots (i.e., the Mbili-Mbili system has the same pigeon pea density as in other maize-pigeon pea treatments). The research protocol gives details on the treatments, trial design and data collection and analysis. | | | | | | | | | | |
|  | | | | | | | | | | |
| 5. Data to be collected and uploaded on Dataverse | | | | | | | | | | |
| Domain & *Indicator* | Field/plot level metrics | | | Farm level metrics | Household level metrics | | | Community/landscape metrics | Measurement method | |
| Productivity | | | | | | | | | | |
| *Crop productivity* | *Maize, beans, pigeon pea and cowpea productivity* (kg/ha/season) | | |  |  | | |  | Yield measurements | |
| *Variability of production* |  | | |  | Rating of production risk | | |  | Farmer evaluation | |
| *Biomass productivity* | Maize, beans, pigeon pea and cowpea biomass productivity (kg/ha/season) | | |  |  | | |  | Yield measurements | |
| Residue production (kg/ha/season) | | |  |  | | |  | Yield measurements | |
| Rating of residue production | | |  |  | | |  | Farmer evaluation | |
| Economic | | | | | | | | | | |
| *profitability* *and labor requirements* | Gross margins ($/crop/ha/ season) | | |  |  | | |  | Participatory evaluation | |
| *Labor requirement* | Labor requirement (hours/ha) | | |  | Farmer rating of labor | | |  | Farmer evaluation | |
| *Variability of profitability* |  | | |  | Probability of low profitability | | |  | Farmer evaluation | |
| Environment | | | | | | | | | | |
| *Vegetative cover* | % Vegetative cover by type | | |  |  | | |  | Remote sensing | |
| *Fuel availability, soil* | Fuel biomass (kg/ha/season) | | |  |  | | |  | Participatory exercise | |
| *Soil chemical quality* | Soil nutrient levels (g/kg) | | |  |  | | |  | Soil tests | |
| Biological nitrogen fixation  (kg N ha-1) | | |  |  | | |  | Soil tests | |
| *Soil physical quality* | Infiltration rate | | |  |  | | |  | Soil tests | |
| Human condition | | | | | | | | | | |
| *Nutrition* | Protein production (g/ha) | | |  |  | | |  | Lookup tables | |
| *Food security* | Food production (Calories/ha/year) | | |  | Months of food insecurity; Rating of food security | | |  | Field measurement/ lookup tables | |
| Social | | | | | | | | | | |
| *Gender equity* |  | | |  | Time allocation by gender | | |  | Key informant interviews | |
|  | | |  | Management control by gender | | |  | Key informant interviews | |
| Income by gender | | |  | Income by gender | | |  | Key informant interviews | |
| Rating of technologies by gender | | |  | Rating of technologies by gender | | |  | Key informant interviews | |
| Food security by gender | | |  | Food security by gender | | |  | Key informant interviews | |
| *Equity (generally)* |  | | |  | Rating of technologies by group | | |  | Focus group discussions (for farmers hosting trials) | |
|  | | | | | | | | | | |
| 6. Deliverables | | | | | | | Means of verification | | | Delivery date |
| 6.1 Six on-farm trials, 2 in each of 3 eco-zones, successfully Implemented | | | | | | | Research reports | | | Oct. 2020 |
| 6.2 Three new technologies introduced and tested | | | | | | | Research reports | | | Oct. 2020 |
| 6.3 BNF of pigeon pea quantified | | | | | | | Research reports | | | Nov. 2020 |
| 6.4 Hundred-and-fifty farmers trained (in field days) | | | | | | | Field day reports | | | Oct. 2020 |
| 6.5 Focus group discussions conducted | | | | | | | Focus group discussion report | | | Oct. 2020 |
|  | | | | | | | | | | |
| 7. How will scaling be achieved? | | | | | | | | | | |
| We have developed a field guide that will form the basis of discussions with World Vision and with Cosita to potentially scale-out best practices in general. Besides, we will demonstrate the performance of Mbili-Mbili and double-up legume and our new lesson of an ability to produce 2 bean crops during 1 season to these development partners. Already, we presented posters of these technologies during the NaneNane agricultural exhibition. We will also utilize the Mwanga ICT platform when communicating agronomic information. We are partnering with Meru Agro Seed Company to deliver Improved maize seeds and provide advice to farmers. | | | | | | | | | | |
|  | | | | | | | | | | |
| 8. How are the activities in this protocol linked to those of others? | | | | | | | | | | |
| This study provides data that will feed into farm-level assessments led by Dr. Lieven Claessens. Although measured by CIAT, quantities of strippings and toppings link with livestock feed provisioning (ILRI and TALIRI=Tanzania Livestock Research Institute) that again feeds to the farm level assessments. Double-up legumes work, also contained in protocols for Kongwa-Kiteto and Malawi, provides an opportunity for cross-site comparisons. | | | | | | | | | | |

9. Gantt chart

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **2019** | **2020** | | | | | | | | | |
| **Dec** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** |
| Input acquisition, Field marking, Planting trials and babies |  |  |  |  |  |  |  |  |  |  |  |
| Partner visits for platform pitches and co-development of Mwanga messages |  |  |  |  |  |  |  |  |  |  |  |
| Soil sampling, pre-processing, analysis and top dressing |  |  |  |  |  |  |  |  |  |  |  |
| Protocol development, delivering field decision guide & reporting |  |  |  |  |  |  |  |  |  |  |  |
| Field days, rating of technologies and bean harvesting, 2nd top dressing |  |  |  |  |  |  |  |  |  |  |  |
| Topping and stripping activities |  |  |  |  |  |  |  |  |  |  |  |
| Maize harvesting, drying, weighing, sample pre-processing |  |  |  |  |  |  |  |  |  |  |  |
| BNF sampling and phenotypical assessment |  |  |  |  |  |  |  |  |  |  |  |
| Light interception, soil moisture measurement |  |  |  |  |  |  |  |  |  |  |  |
| Weeds, pests, disease control |  |  |  |  |  |  |  |  |  |  |  |
| BNF sample preprocessing, shipping and plant isotope analysis |  |  |  |  |  |  |  |  |  |  |  |
| Pigeon pea harvesting, soil water infiltration tests, conducting FGD’s |  |  |  |  |  |  |  |  |  |  |  |
| Litter fall assessment |  |  |  |  |  |  |  |  |  |  |  |
| Mwanga messaging |  |  |  |  |  |  |  |  |  |  |  |
| Seasonal data analysis, dataverse publishing, end of year reporting |  |  |  |  |  |  |  |  |  |  |  |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Outcome 1: Productivity, diversity, and income of crop-livestock systems in selected agro-ecologies enhanced under climate variability | | | | | | | | | | | | | | |
| a. Output 1.1 | | | | Demand-driven, climate-smart, integrated crop-livestock research products (contextualized technologies) for improved productivity, diversified diets, and higher income piloted for specific typologies in target agro-ecologies | | | | | | | | | | |
| b. Activity 1.1.1 | | | | Assess and iteratively improve resilient crop-crop and crop-livestock integration systems | | | | | | | | | | |
| c. Sub-activity 1.1.1.7 | | | | Monitoring the impact of weather and climate variability on the productivity and resilience of maize-legume cropping systems of Kongwa and Kiteto, Tanzania. | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| d. Research team | | | | | | | | | | | | | | |
| Name | | Institution | | | Role | | | | | | | | | |
| Mawazo Shitindi | | SUA | | | PI, designing and leading the research, supervising graduate student and overseeing the project activities | | | | | | | | | |
| Francis Muthoni | | IITA | | | Modelling the impact of weather variability on performance and resilience of maize legume-based cropping systems | | | | | | | | | |
| Anthon Kimaro | | ICRAF | | | Providing historical maize and legume productivity and resilience data from Gliricidia-based cropping systems | | | | | | | | | |
| Elirehema Swai | | TARI Hombolo | | | Providing historical maize - legume productivity data from soil water management technologies | | | | | | | | | |
|  | | ICRISAT | | | Source of pigeon peas and groundnut varieties for research | | | | | | | | | |
| DAICO’s | | Kongwa and Kiteto DC. | | | Backstopping of maize legume – historical productivity data for modelling | | | | | | | | | |
| Anicet Sambala | | IITA | | | M&E Support | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| e. Students: | | | | | | | | | | | | | | |
| Name | | | Institute | | | | Degree | | | | Start | | | End |
| Mushi Revocatus | | | SUA | | | | MSc. Soil Science and Land Management | | | | Jan. 2019 | | | Nov. 2021 |
|  | | | | | | | | | | | | | | |
| f. Locations: | | Mlali village of Kongwa district and Njoro village of Kiteto District | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| g. Start date | | 2018 -new sub-activity building on what has been done by TARI and ICRAF since 2014 | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| h. End date | | 2021 | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 1. Justification | | | | | | | | | | | | | | |
| The impact of weather and climate variability and change is more remarkable on rain-fed agriculture in the arid and semiarid lands. In Tanzania, rainfall has significantly decreased in recent years, and further rainfall decrease is expected by the mid of this century. A positive correlation is reported between weather variability and crop yields under rain-fed agriculture. For example, 20% increase in intra-seasonal precipitation variability has been reported to reduce yields of maize, sorghum and rice by 4.2%, 7.2%, and 7.6%, respectively (Rowhani *et al*., 2011[[14]](#footnote-14)). Assessment of the effects of weather and climate variability on agriculture and environment is necessary to design proper adaptation and mitigation measures that improve resilience (IPCC, 2014[[15]](#footnote-15)). Weather data for such an assessment in semi-arid areas of Kongwa and Kiteto is scanty and unreliable. With newly installed weather stations, monitoring of key weather variables will be undertaken, as well as establishing the correlation between weather variability and productivity of maize–legume cropping systems and modelling the impact of weather variability on future productivity and resilience of maize legumes cropping systems for informed decision making. | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | | | | | |
| 2.1 Monitor the variability of key weather elements and establish the effect of short- and long-term weather variability on the productivity of maize-legume cropping systems in the semi-arid central Tanzania | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | | | | | |
| 3.1 What impact does weather variability have on the productivity of maize-legume cropping systems in semi-arid central Tanzania? | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | | | | | |
| Experiment design, implementation and data analysis:  Key weather variables (rainfall, temperature, evapotranspiration, relative humidity, solar radiation, wind direction and wind speed, will be automatically recorded using Watchdog 2000 series automatic weather station installed at Mlali and Njolo villages and off-loaded once every month. Daily, monthly and annual ranges will be computed to establish the trends. For monitoring weather variability, historical weather data for ten or more seasons will be obtained from satellite platforms. Respective crop yield data will be collected from research works previously conducted in the two sites for modeling the effect of weather and climate variability on crop yields. | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 5. Data to be collected and uploaded on Dataverse | | | | | | | | | | | | | | |
| Domain & *Indicator* | Field/plot level metrics | | | | | Farm level metrics | | Household level metrics | | Community/landscape metrics | | | Measurement  method | |
| Productivity | | | | | | | | | | | | | | |
| *Crop productivity* | *Historical and current maize, pigeon peas and groundnut grain and Stover or wood yield (t/ha/yr)* | | | | |  | |  | |  | | |  | |
| Economic | | | | | | | | | | | | | | |
| *Profitability* | Profitability (gross margin in USD/ha) associated with variability of weather elements. | | | | |  | |  | |  | | |  | |
| Environment | | | | | | | | | | | | | | |
| *Weather conditions* | Variability of key weather elements including rainfall (mm/day/week/month/season/year); Rainfall distribution (Number of rain days/ weeks/months in a season or year); Maximum and minimum temperature (⁰C); Daily, monthly and annual temperature range (⁰C), photosynthetically active radiation (PAR) | | | | |  | |  | |  | | |  | |
| Human condition | | | | | | | | | | | | | | |
| *Food security* | Food availability (number of food sufficiency month per household/year | | | | |  | |  | |  | | |  | |
| Social | | | | | | | | | | | | | | |
| *Gender* | Gender perception of weather variability and associated impacts on crop productivity | | | | |  | |  | |  | | |  | |
|  | | | | | | | | | | | | | | |
| 6. Deliverables | | | | | | | | | Means of verification | | | Delivery date | | |
| 6.1 Historical weather and crop yield data | | | | | | | | | Data sets uploaded on Dataverse | | | Mar. 2020 | | |
| 6.2 The level of understanding of weather/climate variability and associated impacts on cereal and legume production among the communities in Kongwa and Kiteto districts established | | | | | | | | | Survey report | | | Apr. 2020 | | |
| 6.3 One automated weather station installed in each research site (Kongwa and Kiteto) and weather is recorded monthly | | | | | | | | | Monthly weather data | | |  | | |
| 6.4 At least 12 lead farmers, 3 extension workers and 2 research assistants trained on the use of automated weather stations, weather/climate variability and mitigation of associated impacts on crop production | | | | | | | | | Training report | | | Jun. 2019 | | |
| 6.5 Variability of weather/climate and associated impacts on the yield of maize, pigeon peas and other food legumes traced in Kongwa and Kiteto | | | | | | | | | Weather variability and crop yield data sets | | | Aug. 2020 | | |
|  | | | | | | | | | | | | | | |
| 7. How will scaling be achieved? | | | | | | | | | | | | | | |
| Partnership with District Agricultural and Livestock Development offices (DAICOs), Tanzania Meteorological Agency and agricultural-based NGOs | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 8. How are the activities in this protocol linked to those of others? | | | | | | | | | | | | | | |
| Choice crop varieties for testing the impact of weather variability on crop yield are validated with crop improvement (ICRISAT) and agronomic practices for the new varieties are validated with the S&WC (TARI Hombolo). | | | | | | | | | | | | | | |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Outcome 1: Productivity, diversity, and income of crop-livestock systems in selected agro-ecologies enhanced under climate variability | | | | | | | | | | | |
| a. Output 1.1 | | | Demand-driven, climate-smart, integrated crop-livestock research products (contextualized technologies) for improved productivity, diversified diets, and higher income piloted for specific typologies in target agro-ecologies | | | | | | | | |
| b. Activity 1.1.2 | | | Assess and iteratively improve resilient crop-crop and crop-livestock integration systems | | | | | | | | |
| c. Sub-activity 1.1.2.1 | | | Assessment of the benefits of management technologies on the performance of improved vegetable varieties (Season 2) | | | | | | | | |
|  | | | | | | | | | | | |
| d. Research team | | | | | | | | | | | |
| Name | | | | Institution | | | | Role | | | |
| Justus Ochieng | | | | WorldVeg | | | | PI | | | |
| Ludovic Joly | | | | Iles de Paix (IDP) | | | | To support scaling of vegetable technologies and fund nutrition activities in 8 new villages | | | |
| IFPRI | | | | IFPRI | | | | M&E support | | | |
|  | | | | | | | | | | | |
| e. Students: Nil | | | | | | | | | | | |
|  | | | | | | | | | | | |
| f. Location(s): | | 8 Villages in Karatu District, Tanzania: Kambi ya samba, Bashay, Buger, Gyekrumlambo, Slahhamo, Rhotia Kainam, Chem, Changarawe plus new 8 villages) | | | | | | | | | |
|  | | | | | | | | | | | |
| g. Start date | | January 2019 | | | | | | | | | |
|  | | | | | | | | | | | |
| h. End date | | 30 September 2020 | | | | | | | | | |
|  | | | | | | | | | | | |
| 1. Justification | | | | | | | | | | | |
| Vegetables are valuable sources of energy, micronutrients and income generation for the rural and urban population. Traditional vegetables are important for providing micronutrients and are well adapted to harsh climatic conditions and disease infestation and are easier to grow. However, low production per unit area is the major challenge. Declining vegetable yields is the result of poor farming practices such as the use of poor-quality seeds, poorly sowed and managed seedlings, inadequate application of manures, limited water for production, misuse and abuse of inorganic fertilizers, and rampant use of pesticides. Improved management practices (IM), combines technological packages of good quality improved seed varieties, healthy seedlings, good agronomic practices (GAPs), can potentially provide pathways out of hunger and poverty. WorldVeg will introduce three improved varieties of vegetables; tomato and traditional vegetables (African eggplant and Ethiopian mustard). The current research is based on the premise that growing improved vegetable varieties should be combined with improved and safer practices that will contribute to more diverse, healthier and balanced diets while also increasing farm household income.  Farmers acknowledged and appreciated the training on Integrated Pest Management (IPM) (insect traps, making biopesticides etc.) and production practices such as line sowing, making compost manure, fertilizer application and installing an irrigation system. Therefore, in the second season, these two activities will be implemented again in 8 villages to validate the results of the first season. | | | | | | | | | | | |
|  | | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | | |
| 2.1 To assess the impact of improved management practices (improve varieties and good agricultural practices) on yield, reduction insect pests and profitability of growing different vegetables (e.g. African nightshade, tomato and Ethiopian mustard). | | | | | | | | | | | |
| 2.2 To analyze the impact of improved management practices at farm level through a case study of two farmers who will be selected in the already hosting villages. | | | | | | | | | | | |
|  | | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | | |
| 3.1 What is the impact of improved management practices on vegetable pests, yield and profits? | | | | | | | | | | | |
|  | | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | | |
| Experiment design, implementation and data analysis:  The study will follow an on-farm participatory research approach. The research trial will be a Randomized Complete Block Design (RCBD) which makes it easy to conduct experiments with farmers. The treatments will include 3 improved crop varieties X management (+/- improved management practices). | | | | | | | | | | | |
|  | | | | | | | | | | | |
| 5. Data (with indicators and metrics) to be collected and uploaded on Dataverse | | | | | | | | | | | |
| Domain & *Indicator* | Field/plot level metrics | | | | Farm level metrics | Household level metrics | | | Community/landscape metrics | Measurement method | |
| Productivity | | | | | | | | | | | |
| *Vegetable productivity* | Kg/ha/season | | | | Kg/ha/season | - | | | Rating of yielda - | Yield measurement  aFarmer evaluation | |
| *Post-harvest loss* | - | | | | - | % of harvest lost | | | - | Direct measurements | |
| Economic | | | | | | | | | | | |
| *Profitability* | Gross margin ($/crop/ha/ season) | | | | Gross margin ($/crop/ha/season) | Gross margin ($/crop/ha/season) | | | - | Direct measurements | |
| *Market participation* | - | | | | - | % production sold | | | Total sales | Direct measurements | |
| *Input intensity* | - | | | | Input/ha/season | Input/ha/season | | | - | Direct measurements | |
| Environment | | | | | | | | | | | |
| *Pesticide use* | Active ingredient applied (kg/ha) | | | | Active ingredient applied (kg/ha) | - | | | - | Direct measurements | |
| *Pest levels* | Pest abundance and severity by type | | | | - | - | | | - | Seasonal transects | |
| Human Condition | | | | | | | | | | | |
| *Nutrition* | - | | | | - | Access to nutritious vegetables (no. of veg. consumed) | | | - | Survey | |
|  | | | |  | Amount consumed (g/day) | | | % of households consuming below minimum |
| Social | | | | | | | | | | | |
| *Gender equity* | Rating of technologies by gender | | | | Rating of technologies by gender | Rating of technologies by gender | | | - | Focus group discussions (FGD) | |
|  | Market participation by gender | | | | Market participation by gender | Market participation by gender | | | - | FGD/Survey | |
|  | | | | | | | | | | | |
| 6. Deliverables: | | | | | | | Means of verification | | | | Delivery date |
| 6.1 Season 2 data on impact of improved management practices on vegetable production collected | | | | | | | Data set (in data verse) | | | | Aug. 2020 |
| 6.2 Draft paper on the impact of improved management practices | | | | | | | Draft paper | | | | Sep. 2020 |
| 6.3 One field day for farmers conducted | | | | | | | Farmer field day reports | | | | Jul. 2020 |
| 6.4 At least 1 success/blog story | | | | | | | Success story submitted to Africa RISING Comms. | | | | Sep. 2020 |
|  | | | | | | | | | | | |
| 7. How will scaling be achieved? | | | | | | | | | | | |
| Islands of Peace (IDP), an NGO in Karatu District, will scale the technologies to eight new villages with an estimated membership of 350 households within Karatu district and to other regions where they are conducting development activities (see sub-activity 5.2.2.1). | | | | | | | | | | | |
|  | | | | | | | | | | | |
| 8. How are the activities in this protocol linked to those of others? | | | | | | | | | | | |
| Improved vegetable varieties and good agronomic practices for new traditional African vegetables (TAV) are being scaled by IDP (sub-activity 5.2.2.1). The Livestock component of the ESA Project is utilizing vegetable wastes to prepare feed rations: “Sub-Activity 5.1.4.2: Demonstrate the effect of home-made feed rations based on Gliricidia sepium and vegetable waste on the productivity of selected strains of chickens. | | | | | | | | | | | |
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9. Gantt Chart

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| **Main Activity** | **Description/Sub-Activity** | **2019** | | | **2020** | | | | | | | | | |
| **Oct** | **Nov** | **Dec** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** |
| Introduction and promotion of improved varieties and good agricultural practices (GAP) in new and old villages (Lead-WorldVeg) | Nursery establishment and nursery management practices |  |  |  |  |  |  |  |  |  |  |  |  |
| Establish research trials plot and transplant seedlings (practices) |  |  |  |  |  |  |  |  |  |  |  |  |
| Distribution of seed kits (distribution of seed kits to trainees) |  |  |  |  |  |  |  |  |  |  |  |  |
| Good agricultural practices (GAP) and IPM practices |  |  |  |  |  |  |  |  |  |  |  |  |
| Proper harvesting and post-harvest principles and technologies |  |  |  |  |  |  |  |  |  |  |  |  |
| Data collection/seasonal transects/FGD |  |  |  |  |  |  |  |  |  |  |  |  |
| Community empowerment (Lead: WorldVeg) | 1 Field day |  |  |  |  |  |  |  |  |  |  |  |  |
| Backstopping IDP to scale improved management practice in new villages (Lead: IDP) | Participate in awareness creation (vegetable farming as a business (value chain thinking) |  |  |  |  |  |  |  |  |  |  |  |  |
| Train IDP staff how to effectively scale out the improved technologies |  |  |  |  |  |  |  |  |  |  |  |  |
| Nutrition training in new villages (Lead: WorldVeg) | Nutrition message training |  |  |  |  |  |  |  |  |  |  |  |  |
| Train food kiosks on recipe preparation and evaluate recipe acceptability |  |  |  |  |  |  |  |  |  |  |  |  |
| Focus groups discussions and Key informant interviews (KII) to assess collective action activities |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Survey/FGD to assess/monitor the uptake of nutritious recipes |  |  |  |  |  |  |  |  |  |  |  |  |
| Monitoring & Evaluation (Lead: WorldVeg) | Regular M&E visits to support partner IDP |  |  |  |  |  |  |  |  |  |  |  |  |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Outcome 1: Productivity, diversity, and income of crop-livestock systems in selected agro-ecologies enhanced under climate variability | | | | | | | | | | | |
| a. Output 1.2 | | Demand-driven, labor-saving and gender-sensitive research products to reduce drudgery while increasing labor efficiency in the production cycle piloted for relevant typologies in target areas | | | | | | | | | |
| b. Activity 1.2.1 | | Support local partners through training on appropriate drudgery-reducing technology delivery (No sub-activity was proposed here during 2019-2020) | | | | | | | | | |
| Activity 1.2.2 | | Co-adapt existing mechanization options with target communities | | | | | | | | | |
| c. Sub-activity 1.2.2.1 | | Use of tractor mounted ripper tillage implement for enhancing soil water infiltration and moisture conservation in semi-arid areas of Kiteto | | | | | | | | | |
|  | | | | | | | | | | | |
| d. Research team | | | | | | | | | | | |
| Name | | | Institution | | | | Role | | | | |
| Elirehema Swai | | | TARI Hombolo | | | | Research design and oversight of the project activities | | | | |
| Gundula Fischer | | | IITA and UDOM | | | | Gender studies | | | | |
| Julius Manda | | | IITA | | | | Economics studies as well as providing technical backstopping to UDOM economist | | | | |
| Lutengano Edward Mwinuka | | | University of Dodoma | | | | Economic data collection at Kiteto and Kongwa Districts | | | | |
|  | | | | | | | | | | | |
| e. Students: N/A | | | | | | | | | | | |
|  | | | | | | | | | | | |
| f. Location | | | | | Kiperesa village in Kiteto District | | | | | | |
|  | | | | | | | | | | | |
| g. Start date | | | | | 2016/2017 | | | | | | |
| h. End date | | | | | Sept 2021 | | | | | | |
|  | | | | | | | | | | | |
| 1. Justification | | | | | | | | | | | |
| In the semi-arid Kiteto District in Manyara Region, more than 65% of smallholder farmers are using tractor-mounted disc ploughs for primary tillage (<https://cgspace.cgiar.org/handle/10568/16883>). Conversely, more than 50% of smallholder farmers in the Kongwa district rely mostly on the use of oxen-drawn mouldboard plough. In the 2015/2016 cropping season, the use of the tractor mounted ripper was introduced in the Kiteto district to address the challenges associated with plough layer hardpan which restricts the movement of soil and water. The productivity performance of rip tillage using tractor-mounted was evaluated during the 2016/2017 in Njoro and Kiperesa villages as a sound strategy for increasing resilience to climate variability and change. Performance of maize increased by over 30%. However, key information related to the human condition and social domains was not examined during that occasion. The economic benefits associated with a tractor-mounted ripper technology were determined for the first time in 2018/2019 cropping season. However, crop performance was adversely affected by limited soil moisture supply due to inadequate rainfall (i.e. 72 mm of rainfall). Thus during 2019/2020 cropping season, the study will be repeated to quantify the potential benefits of rip tillage in terms of economic gain, labor requirements and soil moisture conservation. | | | | | | | | | | | |
|  | | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | | |
| 2.1 Determine the economic benefits of rip tillage in semi-arid agro-ecologies of Central Tanzania in the face of climate variability and terms of economic gain, labor requirements and soil moisture conservation. | | | | | | | | | | | |
| 2.2 Determine the gender-based value of tractor mounted rip tillage. | | | | | | | | | | | |
|  | | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | | |
| 3.1 What are the potential SI benefits of the rip tillage technique in semi-arid agro-ecologies of Central Tanzania in the face of climate variability in terms of social, economic gain, labor requirements and soil moisture conservation? | | | | | | | | | | | |
|  | | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | | |
| Experiment design, implementation and data analysis:  There will be one researcher-managed factorial experiment with two tillage treatments (conventional farmer practice=CFP, and rip tillage=RT) and two improved maize varieties (a commercial variety & a drought-tolerant variety), giving a total of four treatment combinations. Additionally, 40 farmers randomly selected across the village will each constitute a replication by hosting a complete set of treatments. These farmers constitute a sufficient number for socio-economic study designs (Krishna Kumar, 1989a[[16]](#footnote-16); Krishna Kumar, 1989b[[17]](#footnote-17)). All treatments will receive 20kg P/ha and 18kg N/ha as Diammonium Phosphate (DAP) fertilizer at planting and (40kg N/ha) as Urea fertilizer will be applied as a topdressing.  Data analysis. Analysis of variance for the biophysical variables crop growth/yield, hydrological and physical variables will be run using Genstat software. | | | | | | | | | | | |
|  | | | | | | | | | | | |
| 5. Data to be collected and uploaded on Dataverse | | | | | | | | | | | |
| Domain & *Indicator* | Field/plot level metrics | | | Farm level metrics | | Household level metrics | | | Community/landscape metrics | Measurement method | |
| Productivity | | | | | | | | | | | |
| *Crop (maize) productivity* | Maize grain yield (kg/ha/season) | | |  | |  | | |  | Yield measurements | |
| *Crop biomass productivity* | Stover production (kg/ha/season) | | |  | |  | | |  | Yield measurements | |
| Environment | | | | | | | | | | | |
| *Soil physical quality* | Soil bulk density (g/cm3) | | |  | |  | | |  | Soil test | |
| *Water availability -* | Soil moisture content (%) | | |  | |  | | |  | Field tests | |
|  | Infiltration (mm) | | |  | |  | | |  | Field tests | |
| Social | | | | | | | | | | | |
| *Equity* |  | | |  | |  | | | Farmers’ perception of rip tillage segregated by gender | Participatory evaluation.  Focus group discussion | |
| *Capacity to experiment* |  | | |  | |  | | | % of farmers experimenting | Individual survey  Focus group discussion | |
| Economic (UDOM) | | | | | | | | | | | |
| *Profitability* | Gross margin ($/ha) | | | Gross margin | |  | | |  | Participatory evaluation | |
| *Labor requirement* | Labor requirement (hours/ha) | | | Labor requirement (hours/ha) | |  | | |  | Farmer evaluation | |
| Human condition | | | | | | | | | | | |
| *Food security* | Food production (calories/ha/year) | | |  | |  | | |  | Lookup tables | |
|  | | | | | | | | | | | |
| 6. Deliverables | | | | | | | | Means of verification | | | Delivery date |
| 6.1 One researcher-managed trial and forty (40) farmer replicate trials under rip tillage technique prepared using tractor-mounted ripper established in Kiteto District Council | | | | | | | | Field establishment report | | | Feb. 2020 |
| 6.2 Accrued benefits on productivity and environment, associated with the use of rip tillage technology quantified in semi-arid zones of Kiteto in Manyara Region | | | | | | | | Progress Report | | | Sep. 2020 |
| 6.3 At least 300 farmers and other stakeholders attend farmers’ field day at Kiperesa in Kiteto District | | | | | | | | Farmers Field Day Report | | | Jul. 2020 |
| 6.4 Modalities for rollout out of rip tillage technology in semi-arid of Kiteto through engagement extension officers and ward councillors mapped | | | | | | | | Partner engagement Report | | | Aug. 2020 |
| 6.5 Data analysis and interpretation | | | | | | | | Draft manuscript | | | Sep. 2020 |
|  | | | | | | | | | | | |
| 7. How will scaling be achieved? | | | | | | | | | | | |
| Through the engagement of ward/village extension officers and councilors in Kiteto District in Manyara Region. Farmer field days will be conducted to showcase the efficacy of the rip tillage technique. On those occasions, stakeholders who have key roles in the dissemination of agricultural innovations will be invited. | | | | | | | | | | | |
|  | | | | | | | | | | | |
| 8. How are the activities in this protocol linked to those of others? | | | | | | | | | | | |
| The rip tillage technology is being validated with improved drought-tolerant maize variety released recently under ongoing Water Efficient Maize for Africa (WEMA) Project in Tanzania. It is linked to sub-activity 4.1.1.1 of last year. Assess the effect of tied ridging, residual tied and rip tillage on maize productivity, net crop returns, household income and food security. It also linked to Sub-activity 5.1.7.2: Gender analysis of soil and water conservation technologies which will generate data/information addressing the social domain component. | | | | | | | | | | | |

9. Gantt chart

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Activity** | | **2019** | | | **2020** | | | | | | | | | |
| **Oct** | **Nov** | **Dec** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sept** |
| 1 | Conduct feedback meeting with participating farmers in Kiteto District. |  |  |  |  |  |  |  |  |  |  |  |  |
| 2 | Preparation of research materials for trials in Kiteto District |  |  |  |  |  |  |  |  |  |  |  |  |
| 3 | Prior arrangement of tractor mounted ripper |  |  |  |  |  |  |  |  |  |  |  |  |
| 4 | Layout of experimental plots |  |  | |  |  |  |  |  |  |  |  |  |
| 5 | Land preparation (Rip lines/Flat cultivation / |  |  |  |  |  |  |  |  |  |  |  |  |
| 6 | Planting of trials at Kiperesa |  |  |  |  |  |  |  |  |  |  |  |  |
| 7 | Management of trials/crop management |  |  |  |  |  |  |  |  |  |  |  |  |
| 8 | Data collection on biophysical variables |  |  |  |  |  |  |  |  |  |  |  |  |
| 9 | Conduct farmer Field days at in Kiteto/Kongwa |  |  |  |  |  |  |  |  |  |  |  |  |
| 10 | Participate in NaneNane agricultural shows |  |  |  |  |  |  |  |  |  |  |  |  |
| 11 | Harvesting of trials |  |  |  |  |  |  |  |  |  |  |  |  |
| 12 | Data processing and analysis |  |  |  |  |  |  |  |  |  |  |  |  |
| 13 | Meeting with project team members |  |  |  |  |  |  |  |  |  |  |  |  |
| 14 | Dataverse uploading |  |  |  |  |  |  |  |  |  |  |  |  |
| 15 | Preparation of final technical report |  |  |  |  |  |  |  |  |  |  |  |  |
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| Outcome 1: Productivity, diversity, and income of crop-livestock systems in selected agro-ecologies enhanced under climate variability. | | | | | |
| a. Output 1.3 | | Tools (including ICT-based) and approaches for disseminating recommendations in relation to above research products, integrated into capacity development | | | |
| b. Activity 1.3.1 | | Conduct extrapolation domain analysis based on GIS, agro-ecology, and crop model-generated information to establish the potential of technologies for geographical reach | | | |
| c. Sub-activity 1.3.1.1 | | Farmer/Extension messaging (forage production and use, crop residue processing and use and feed rations) using MWANGA | | | |
|  | | | | | |
| d. Systems research team | | | | | |
| Name | Institution | | | Role | |
| Ben Lukuyu | ILRI | | | PI: develop livestock and feed messages, assess effectiveness of these messaging | |
| Leonard Marwa | TALIRI West Kilimanjaro | | | Technical backstopping on preparing and delivering livestock messages | |
| Mbesere | Extension staff Babati district | | | Cross-check and translate messages | |
|  | ESOKO | | | Messaging | |
|  | IITA | | | Develop food safety messages | |
|  | Development partners (COSITA, World Vision) | | | Intelligence of farmer messaging monitor farmer feedback | |
|  | ILRI | | | Develops Integrated soil/fertilizer messages | |
|  | | | | | |
| e. Students: Nil | | | | | |
|  | | | | | |
| f. Location | All villages, Babati District | | | | |
|  | | | | | |
| g. Start date | 2018 | | | | |
|  | | | | | |
| h. End date | 2020 | | | | |
|  | | | | | |
| 1. Justification | | | | | |
| (This sub-activity has been carried forward from the research year 2018-2019 since it has not been finalized)  Farmer/Extension messaging (forage production and use, crop residue processing and use and feed rations) using MWANGA. This activity will involve developing short, clear and target messages for dissemination to farmers via SMS aimed at increasing dairy and poultry productivity. This activity is a collaboration between several Africa RISING teams and is led by IFPRI. Other institutions include IITA, CIAT-Kenya and CIAT Rwanda. ILRI will develop and contribute livestock messages that will be disseminated through the MWANGA platform. | | | | | |
|  | | | | | |
| 2. Objectives | | | | | |
| 2.1 Improve the knowledge of farmers on forage production and use, crop residue processing and use, feed rations | | | | | |
|  | | | | | |
| 3. Research questions | | | | | |
| 3.1 How much can SMS messaging technology reduce key knowledge gaps amongst smallholder farmers? | | | | | |
|  | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | |
| There will be a common MWANGA protocol produced by IPFRI that partners will refer to. | | | | | |
|  | | | | | |
| 5. Data to be collected and uploaded on Dataverse N/A | | | | | |
|  | | | | | |
| 6. Deliverables | | | Means of verification | | Delivery date |
| 6.1 Baseline survey of current Knowledge, Practices and Attitudes amongst farmers before the intervention | | | Project report to IITA | | Mar. 2020 |
| 6.2 At least 10 messages to farmers and extension staff about improved technologies disseminated through SMS | | | Project report to IITA with message content and dates | | Jul. 2020 |
| 6.3 End line survey to measure the change in Knowledge, Practices and Attitudes from target farmers | | | Project report provide through quarterly reporting | | Aug. 2020 |
| 6.4 Complete data analysis | | | Project report to IITA | | Aug. 2020 |
| 6.5 Report to IITA about sub-activity completion | | | Report | | Sep. 2020 |
|  | | | | | |
| 7. How will scaling be achieved? | | | | | |
| Partnership with COSITA and World Vision to deliver technology to about 200 farmers through the platform. | | | | | |
|  | | | | | |
| 8. How are the activities in this protocol linked to those of others? N/A | | | | | |

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| Outcome 1: Productivity, diversity, and income of crop-livestock systems in selected agro-ecologies enhanced under climate variability. | | | | | | | | | | |
| a. Output 1.3 | | | | Tools (including ICT-based) and approaches for disseminating recommendations in relation to above research products, integrated into capacity development. | | | | | | |
| b. Activity 1.3.1 | | | | Conduct extrapolation domain analysis based on GIS, agro-ecology, and crop model-generated information to establish the potential of technologies for geographical reach. | | | | | | |
| c. Sub-activity: 1.3.1.2. | | | | Produce regionally relevant extrapolation domain maps for validated conservation agriculture (CA) practices. | | | | | | |
|  | | | | | | | | | | |
| d. Research team | | | | | | | | | | |
| Name | | | Institution | | | | Role | | | |
| Francis Muthoni | | | IITA | | | | PI | | | |
| Christian Thierfelder | | | CIMMYT | | | | Provide technologies and their validation data | | | |
| Lieven Claessens | | | IITA | | | | Systems analysis | | | |
|  | | | | | | | | | | |
| e. Student | | | | | | | | | | |
| Name | | Institute | | | | Degree | | Start | | End |
| Vacancy available | | TBD | | | | MSc | | 01/10/2019 | | 30/09/2020 |
|  | | | | | | | | | | |
| f. Location | ESA Region | | | | | | | | | |
|  | | | | | | | | | | |
| g. Start | Sep. 2018 | | | | | | | | | |
|  | | | | | | | | | | |
| h. End | Sep. 2021 | | | | | | | | | |
|  | | | | | | | | | | |
| 1. Justification | | | | | | | | | | |
| Sustainable intensification technologies are suited to specific biophysical and socio-economic context. Technologies validated at a particular location should be suitable for scaling to other locations with relatively similar biophysical and socio-economic context. Identification of areas with relatively similar conditions or outcomes to that observed in the technology trial sites is one of the essential components of successful scaling out. Biophysical conditions or yields obtained from trial sites with good performance of particular technological packages will be used as a reference for mapping other potentially suitable sites in ESA region. The generated recommendation domain or suitability maps is a step towards establishing regional relevance of Africa RISING validated technologies. The generated suitability maps will guide development partners and extension agencies to scale-out technologies to relevant context thus reducing the risk of failure for AR validated technologies. During the 2018/2019 cropping season, gridded data on climate, soil physical and chemical properties were obtained, processed and archived in a geodatabase. Data from long-term agronomic trials of conservation agriculture practices and resulting yields of maize and legumes were uploaded on Dataverse. Moreover, an analysis was conducted to identify areas experiencing significant positive and negative climatic trends (rainfall, minimum and maximum temperature). The next step would be to identify the sustainable intensification technologies for targeting to specific zones that match with prevalent climatic trends. The proposed sub-activity will utilize the existing data and knowledge to identify the extrapolation domains for bundles of CA technologies. The current year activities will utilize the agronomic trial data and remote sensing datasets to calibrate a spatially explicit model for predicting yields of maize grown under different treatments of conservation agricultural practices. This to identify the best-bet combinations of CA and other GAPS that produce the highest yields at a particular location. | | | | | | | | | | |
|  | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | |
| Identify where in the ESA region the validated CA technological packages can be extrapolated with the lowest potential risk of failure. | | | | | | | | | | |
|  | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | |
| 3.1 What are biophysical factors that most limit the performance of selected technological packages in their trial sites? | | | | | | | | | | |
| 3.2 Where in ESA region can the validated CA technological packages can be extrapolated with the lowest potential risk of failure? | | | | | | | | | | |
|  | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | |
| This study will utilize data on grain yields and conservation agriculture (CA) practices from on-farm trials together with remote sensing data for biophysical environment. Generally, the CA trials had five treatments although with minor variations in different locations. These treatments are: (1) Control with sole maize and ploughed with convectional mouldboard, (2) CA comprising of sole maize, seeded in lines/furrows made by a ripper, no-tillage and no-burning. Previous year’s ridges retained (but not reformed) and residue retained as mulch; (3) Similar to 2 above but maize was rotated with a legume (cowpea/soybean/groundnut), (4) Similar to 2 above but maize was intercropped with cowpea/soybean/groundnut (See protocol for Sub-Activity 2.2.1.1 for on-farm trials of CA practices in Malawi & Zambia). All trials were geotagged and all GAPS were recorded i.e. the rates of inorganic fertilizer and organic amendments. Data on biophysical conditions for every row of agronomic data will be extracted from remote sensing layers. The on-farm sample data will be split into 70% and 30% for training and evaluating the models respectively. A multivariate random Forests (MRF) model will be used to predict grain yields (response) as a function of different CA practices, other GAPs and biophysical conditions (weather, soil properties and elevation). The root mean square of error (RMSE) of predicted and observed crop yields will be used to evaluate the accuracy of the models. After calibration, the most accurate model will be used for spatial prediction of grain yields for a particular package (variety + CA practices) using gridded biophysical layers. Recommendations for technology packages will be based on predicted crop yields. | | | | | | | | | | |
|  | | | | | | | | | | |
| 5. Data to be collected and uploaded on Dataverse | | | | | | | | | | |
| NA. This sub-activity utilizes the CA systems data already uploaded on Dataverse. Only the maps (deliverables) will be uploaded | | | | | | | | | | |
|  | | | | | | | | | | |
| 6. Deliverables | | | | | Means of verification | | | | Delivery date | |
| 6.1 Extrapolation domains for CA practices mapped | | | | | Maps uploaded in Data-verse | | | | Sep. 2020 | |
| 6.2 Extrapolation domains for CA practices disseminated | | | | | 1 journal article submitted | | | | Sep. 2020 | |
|  | | | | | | | | | | |
| 7. How will scaling be achieved? | | | | | | | | | | |
| Extrapolation domains for maize and CA practices will be disseminated to extension staff and development partners | | | | | | | | | | |
|  | | | | | | | | | | |
| 8. How are the activities in this protocol linked to those of others? | | | | | | | | | | |
| This sub-activity is directly linked with Sub-Activity 2.2.1.1: Continuation of CA systems long-term trials in Malawi and Eastern Zambia | | | | | | | | | | |

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| Outcome 1: Productivity, diversity, and income of crop-livestock systems in selected agro-ecologies enhanced under climate variability | | | | | | | | | |
| a. Output 1.3 | | Tools (including ICT-based) and approaches for disseminating recommendations in relation to above research products, integrated into capacity development | | | | | | | |
| b. Activity 1.3.1 | | Conduct extrapolation domain analysis based on GIS, agro-ecology, and crop model-generated information to establish the potential of technologies for geographical reach | | | | | | | |
| c. Sub-activity 1.3.1.3 | | Ex-ante impact assessment with Trade-off Analysis Model for Multi-Dimensional Impact Assessment (TOA-MD) for regional relevance of evaluated Africa RISING technologies. | | | | | | | |
|  | | | | | | | | | |
| d. Systems research team | | | | | | | | | |
| Name | | | | Institution | | Role | | | |
| Lieven Claessens | | | | IITA | | PI, coordination, systems research, TOA-MD | | | |
| Julius Manda | | | | IITA | | Economics | | | |
| Regis Chikowo, Sieg Snapp | | | | MSU | | Contribute existing data for Malawi & Zambia | | | |
| Christian. Thierfelder | | | | CIMMYT | | Contribute existing data for Malawi & Zambia | | | |
| Anthony Kimaro, Emmanuel Temu | | | | ICRAF | | Contribute existing data for Tanzania | | | |
| Job Kihara | | | | CIAT | | Contribute existing data for Tanzania | | | |
| Elirehema Swai, Mawazo Shitindi | | | | TARI | | Contribute existing data for Tanzania | | | |
| James Mwololo | | | | ICRISAT | | Contribute existing data for Tanzania | | | |
|  | | | | | | | | | |
| e. Students | | | | | | | | | |
| Name | Institute | | | | Degree | | Start | | End |
| Srabashi Ray | OSU | | | | PhD | | 2018 | | 2020 |
|  | | | | | | | | | |
| f. Locations | | | Tanzania, Malawi, Zambia | | | | | | |
|  | | | | | | | | | |
| g. Start date | | | October 2019 | | | | | | |
|  | | | | | | | | | |
| h. End date | | | September 2020 | | | | | | |
|  | | | | | | | | | |
| 1. Justification | | | | | | | | | |
| In the course of the Africa RISING project, a lot of experiments on sustainable intensification technologies have been conducted in targeted agro-ecologies. Multiple technologies proofed successful at the field and farm level in terms of contributing positively to multiple SI domains. While scaling efforts are already on the way, mostly close to the experimental sites (agro-ecology), it would be interesting to ex-ante assess the potential impacts of adoption at the regional level. The Trade-off Analysis Model for Multi-Dimensional Impact Assessment (TOA-MD) provides a useful framework for this. The TOA-MD model uses a statistical characterization of a farming population to ex-ante assess the adoption potential of a new technology (such as SI technologies being investigated in Africa RISING) and its impacts on farm household income, poverty, food security a.o. indicators (Antle *et al*., 2014[[18]](#footnote-18)). Documentation of the model including protocols is available at [www.tradeoffs.oregonstate.edu](http://www.tradeoffs.oregonstate.edu). | | | | | | | | | |
|  | | | | | | | | | |
| 2. Objectives | | | | | | | | | |
| Ex-ante assesses the adoption potential and impacts of Africa RISING SI technologies at the regional scale. | | | | | | | | | |
|  | | | | | | | | | |
| 3. Research questions | | | | | | | | | |
| 3.1 What is the adoption potential and impact of locally tested Africa RISING SI technologies at the broader regional scale? | | | | | | | | | |
|  | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | |
| This analysis is building on, and completely depending on existing data. We will need bio-physical data from the experiments (multiple sites, multiple years), and socio-economic data from ARBES (although these are limited to targeted agro-ecologies) or external sources such as e.g. World Bank’s Living Standard Measurement Study. | | | | | | | | | |
|  | | | | | | | | | |
| 5. Data (with metrics) to be collected and uploaded on Dataverse | | | | | | | | | |
| NA. As stated above, the study is utilizing data already available on Dataverse uploaded by the research team members. | | | | | | | | | |
|  | | | | | | | | | |
| 6. Deliverables | | | Means of verification | | | | | Delivery date | |
| 6.1 Inventory of existing bio-physical data from AR experiments. | | | Dataverse | | | | | Dec. 2019 | |
| 6.2 Setting up TOA-MD model | | | Model ready for data input | | | | | Feb. 2020 | |
| 6.3 Ex ante impact assessment implemented and analyzed | | | Draft journal article | | | | | Sep. 2020 | |

|  |
| --- |
|  |
| 7. How will scaling be achieved? |
| The analysis (spatially explicit adoption potential and impacts) can be useful as a guide for scaling by (development) partners. |
|  |
| 8. How are the activities in this protocol linked to those of others? |
| This activity is linked to (and dependent on) all existing and ongoing activities for data provision. |

## Outcome 2: Natural resource integrity and resilience to climate change enhanced for the target communities and agro-ecologies

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| a. Output 2.1 | | | Demand-driven research products for enhancing soil, land and water resources management to reduce household/community vulnerability and land degradation piloted in priority agro-ecologies | | | | | | | | | |
| b. Activity 2.1.1 | | | Characterize current practices in ESA through identifying formal and informal arrangements for access to and use of water and land resources | | | | | | | | | |
| c. Sub-activity 2.1.1.1 | | | Assessing buffer and adaptive capacity to harness resilience of different farm types | | | | | | | | | |
|  | | | | | | | | | | | | |
| d. Research team | | | | | | | | | | | | |
| Name | | | | | Institution | | | Role | | | | |
| Postdoc (vacancy) | | | | | WUR | | | Modelling and farmer interaction | | | | |
| Jeroen Groot | | | | | WUR | | | Activity coordinator | | | | |
|  | | | | | | | | | | | | |
| e. Students | | | | | | | | | | | | |
| Name | | Institution | | | | | Degree | | | Start | | End |
| Vacancy | | WUR | | | | | MSc | | | 11/19 | | 4/2020 |
|  | | | | | | | | | | | | |
| f. Location | Babati, Tanzania | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| g. Start | 1 Oct. 2019 | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| h. End | 1 Oct. 2020 | | | | | | | | | | | |
| 1. Justification | | | | | | | | | | | | |
| Vulnerability and resilience are two crucial attributes of smallholder farming systems that can be used for analyzing the response to disturbances. We will assess these properties in relation to the buffer and adaptive capacity, which depend on the ‘window of opportunities’ of possible changes in terms of productive, socio-economic and environmental performance indicators, i.e. the ‘solution space’. The vulnerability of the system can be quantified as the distance of selected performance indicators between original and disturbed systems. The buffer capacity will be derived from the size of the solution space that could be obtained after reconfiguration of farm components (crops, animals, fertilizers, etc.) that were present on the original farm, whereas the assessment of adaptive capacity was derived similarly but after allowing innovation by introducing new components to the farm. These features will be different for the various farm types in Babati (Tanzania) since they depend on the context (biophysical and socio-economic) and the resources and activities of farms and households. Below we describe the conceptual basis. The activity builds on existing datasets of farm and household structure and farming (from surveys such as ARBES) practices and the proposed and tested Africa RISING technologies (from project scientists).  Conceptual basis:  A disturbance can be a pest, a drought or a product price decline that negatively affects the farming system performance. The farmer can prepare for or respond to a disturbance by reconfiguring the farm with changes in for instance crop areas, animal numbers, amounts of inputs, selected market channels or management practices to compensate for the effect of the disturbance. The available options for adjustment of the system with existing components and resources can be considered as the ‘buffer capacity’. When the farmer decides to introduce new crops, animals, inputs or practices, the required adjustment and reconfiguration (both in the ecological system and in farm management) is expected to be considerably larger than for the buffer capacity and is reflected in the ‘adaptive capacity’. This illustration of the concepts for an agroecosystem demonstrates that, besides the ecological (self-)organization, the farmer, his flexibility and skills, and his cognitive and managerial capacities will determine the chosen strategy of adaptation and the final effectiveness of reconfiguration, and thus agroecosystem resilience.  All possible combinations of values of performance indicators constitute the ‘window of opportunities’ or ‘solution space’ for a particular system. The potential of a system (P), resulting from the buffer and adaptive capacity, can be derived from the size of the solution space, which defines the options for adjustment of the system. The solution space is delimited by the Pareto frontier (or Pareto surface when more than two performance criteria are included in the analysis), and for assessment of resilience we consider only options that perform at least as good as the existing system. The Pareto frontier can be established using multi-objective optimization, and the area (in 2 dimensions), volume (3 dimensions) or hyper volume (>3 dimensions) of the solution space can be calculated, for instance, relative to a given reference point that represents the existing situation.  This is demonstrated in Figure 1, wherein only the portion of the solution space with improvements in two system indicators (productivity and environmental quality in this case) relative to the existing situation after a disturbance is depicted. The buffer capacity (area B in Figure 1a) is estimated as the solution area corresponding to the reconfiguration of links and flows among the components that are already in the system. The adaptive capacity (area A in Figure 1a) is estimated as the expansion of the solution area when new components are introduced in the system. The potential (P) is estimated as the sum of areas A and B.  Macintosh HD:Users:jeroengroot:Dropbox:Artikelen:027 Resilience:Submitted ES:Figure 1.gif  Figure 1. Portions of solution spaces with future options that perform better for two generic objectives, productivity and environmental quality, relative to disturbed states denoted by red symbols. (a) After a disturbance the system states change following the arrow from point 1 to point 2 (vulnerability v is the distance between points 1 and 2) and move to a more desirable state such as point 3 (resilience r is the distance between points 2 and 3). Area A represents the adaptive capacity and B the buffer capacity of the system after the disturbance. Potential P is calculated are the sum of areas A and B. White symbols denote alternatives for the current system. (b) The potential of a system at consecutive moments in time, with changing attained states (points 1, 3, 5 and 7) and after disturbances (points 2, 4 and 6). | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | | | |
| * 2.1 Analyze input-output relations for farm production activities (cropping, animal husbandry, etc.) * 2.2 Quantify potential effects of disturbances on-farm production activities for multiple performance indicators. * 2.3 Model farm/household level effects of disturbances to assess vulnerability for different farm types * 2.4 Quantify the buffer and adaptive capacity of farms and households of different types * 2.5 Establish pathways to harness farm and household resilience for different farm types | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | | | |
| 3.1 To what extent are productive, socio-economic and environmental performance indicators at the farm and household level affected by biophysical and socio-economic disturbances (e.g. drought, price fluctuation | | | | | | | | | | | | |
| 3.2 What are the buffer and adaptive capacity of different farm and household types for disturbances in terms of selected productive, socio-economic and environmental performance indicators? | | | | | | | | | | | | |
| 3.3 Which efficient pathways for performance improvement can be used to recover after disturbances by different types of farms or households? | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | | | |
| * FarmDESIGN modelling using existing parameterized farms / households for three farm types per region * Inventory of production activities that are used on farms or tested by the project (technologies), these production activities (inputs and outputs) are added to the farm models as input data but can also be used to validate the models * Individual discussions and focus group discussions with farmers and experts to assess the feasibility of changes pathways to harness resilience * Surveys, focus group discussions, farming systems modelling and a serious game. | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 5. Data (with metrics) to be collected and uploaded on Dataverse | | | | | | | | | | | | |
| Domain | | | | Indicator | | | | | Metrics and scale | | | |
| Non-domain | | | | Parameterized model for various farm types per region | | | | |  | | | |
| Productivity | | | | Crop productivity | | | | | Crops yield (kg/ha/year) under regular and disturbed conditions (at field and farm levels) | | | |
|  | | | | Animal productivity | | | | | Animal products (kg/animal/year) under regular and disturbed conditions (at animal and farm levels) | | | |
|  | | | | Input use efficiency | | | | | Product per input (at field, herd and farm levels) | | | |
| Economic | | | | Profitability | | | | | Gross margin of crop and animal operations and operating profit of farm operation (USD) | | | |
|  | | | | Labor requirement | | | | | Labor requirements at field, animal, herd, farm and household levels | | | |
| Environment | | | | Soil chemical quality | | | | | Carbon and nutrient (N, P, K) budgets, losses to air and soil (at field and farm levels) | | | |
| Human condition | | | | Nutrition | | | | | Nutrient production (kg/year) at field and farm levels; Dietary Diversity (using Nutritional functional Diversity/Dispersion) | | | |
|  | | | | Food security | | | | | Food production (kcal/year) at field and farm levels. Food accessibility | | | |
|  | | | | Capacity to experiment | | | | | Willingness to implement a new farm configuration after disturbance | | | |
| Social | | | | Equity | | | | | Rating of farm configurations per group and agency (leadership roles) | | | |
|  | | | | | | | | | | | | |
| 6. Deliverables | | | | | | Means of verification | | | | | Delivery date | |
| 6.1 Journal article submitted | | | | | | PFD of submitted papers | | | | | 1 Oct. 2020 | |
| 6.2 MSc thesis/ student report | | | | | | PDF od reports | | | | | 1 Oct. 2020 | |
| 6.3 Research data generated | | | | | | Data uploaded in Dataverse | | | | | 1 Sep. 2020 | |
|  | | | | | | | | | | | | |
| 7. How will scaling be achieved? | | | | | | | | | | | | |
| Our assessment builds upon a locally validated but general pattern of inter- and intra-household diversity. Since our case study households have been selected as representative for farm types of different resource endowment, we expect our findings to be relevant to most other farms of the same type. (We envision to test the transferability of our results by Focus Group Discussions and individual consultations beyond the current case study site to ensure greater validity). Our findings mean to guide Africa Rising’s scaling effort, in that we reveal how the resilience of the different farm and farmer types can be improved best by which of the Africa RISING technologies. | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 8. How are the activities in this protocol linked to those of others? | | | | | | | | | | | | |
| The modelling exercise builds on past and ongoing Africa RISING trial data i.e. data from the on-farm experiments as well as the farmer-led baby- and upscaled trials. The models will be updated, extended and tested in close collaboration with the Africa RISING-regional coordinators and other project experts in Arusha. | | | | | | | | | | | | |
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9. Gantt chart



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| --- | --- | --- |
| Outcome 2: Natural resource integrity and resilience to climate change enhanced for the target communities and agro-ecologies | | |
| a. Output 2.2 | Innovative options for soil, land and water management in selected farming systems demonstrated at strategically located learning sites | |
| b. Activity 2.2.1 | Set up demonstration and learning sites in target ESA communities | |
| c. Sub Activity 2.2.1.1 | Component long term trials on maize/legume intercropping strategies with pigeon pea, lablab and cowpea | |
|  | | |
| d. Research team | | |
| Name | Institution | Role |
| Christian Thierfelder | CIMMYT | PI, research conceptualization, design |
| Mulundu Mwila | ZARI | Implementation |
| Regis Chikowo | MSU | Data sharing and combined assessment of maize legume intensification strategies |
|  | | |
| e. Student(s): Nil | | |
|  | | |
| f. Location | Msekera Research Station | |
|  | | |
| g. Start date | This is a continuing multi-year study which has been running since 2011 | |
|  | | |
| h. End date | October 2021 | |
|  | | |
| 1. Justification | | |
| The activity stems from the need to sustainably intensify rural farming communities in light of climate change and soil fertility decline. Understanding the processes behind different intensification strategies involving green manure cover crops and grain legumes under conservation agriculture has been a pertinent knowledge gap which will be addressed with research results from this study. Under this activity, four different trials will be carried at Msekera Research Station.  All trials on green manure cover crops (GMCCs) have been designed 3 years ago on special request of Catholic Relief Services (CRS). They needed the scientific evidence to scale GMCC and Agro-forestry systems to larger development areas and this critical evidence for the activity was not available by the time of initiating the trials. As the trees grow slowly and soil fertility improvements cannot be expected in 3 years, we have renewed the request for funding those trials to serve our important scaling partner CRS. A research project like Africa RISING should address the needs of scaling partners to enable efficient research for the development continuum as well.  In addition, the level of funding requested to maintain these trials is minimal and we expect a much greater return on investment maintaining the ties with the development partner and position ourselves for future larger collaborations. | | |
|  | | |
| 2. Objectives | | |
| 2.1 Monitor and evaluate the longer-term effects of Conservation Agriculture practices on soil quality, soil water dynamics, weeds, pests/diseases and crop yield. | | |
| 2.2 To evaluate the performance of green manure cover crops on crop productivity, soil quality and residual effects | | |
| 2.3 To analyze the various pigeon pea management methods that are being advocated in the region - the results of these trials will help to inform stakeholders towards best practice | | |
| 2.4 To test different plant arrangements between maize and *Gliricidia sepium* and evaluate its effects on soil quality and productivity | | |
|  | | |
| 3. Research questions | | |
| 3.1 What are the long-term effects of Conservation Agriculture practices on soil quality, soil water dynamics, weeds, pests/ diseases and crop yields? | | |
|  | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | |
| Experiment design, implementation and data analysis:  The trials will be carried out in randomized complete blocks with 4 (3) replications each. The Gliricidia trial could not be run with 4 replications due to limitations in space at the site. | | |
|  | | |
| 5. Data (with indicators and metrics) to be collected and uploaded on Dataverse | | |

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| --- | --- | --- | --- | --- | --- |
| SI Domain & *Indicator* | Field/plot level metrics | Farm level metrics | Household level metrics | Community/landscape metrics | Measurement method |
| Productivity | | | | | |
| *Crop productivity* | Yield (kg/ha/season); |  |  |  | Yield measurements |
| *Crop biomass productivity* | Residue production (kg/ha/season |  |  |  | Crop cuts for yield measurements |
| Economic | | | | | |
| No data taking |  |  |  |  |  |
| Environment | | | | | |
| *Soil biology* | Total carbon (%) |  |  |  | Soil analysis in laboratory |
| Social | | | | | |
| No data taking |  |  |  |  |  |
| Human | | | | | |
| No data taking |  |  |  |  |  |

|  |  |  |
| --- | --- | --- |
| Note: Other data from economic, social and human domains will not be collected as these are all on-station trials where processes are being researched | | |
|  | | |
| 6. Deliverables | Means of verification | Delivery date |
| 6.1 At least 4 field trials established at Msekera | Trial establishment | Feb. 2020 |
| 6.2 Site description details (soils, seasonal rainfall | Protocol and report | Feb. 2020 |
| 6.3 Report on yield and environmental indicators | Report | Sep. 2020 |
| 6.4 Upload data into Dataverse | Data uploaded | Sep. 2020 |
|  | | |
| 7. How will scaling be achieved? | | |
| * No direct scaling expected from this trial. It focusses on understanding the processes * However, if collaboration with CRS continues, the results will directly feed into their larger development programs * A new project in Zambia called Sustainable Intensification of Smallholder Farmers in Zambia (IFAZ) will take up messages and lessons learned to scale this further. The PI of this project (Christian Thierfelder) will be the PI of SIFAZ as well and lessons learned from both initiatives will be shared between the two programs. | | |
|  | | |
| 8. How are the activities in this protocol linked to those of others? | | |
| The Protocol forms the basis of out scaling plots in farmer’s fields done by CRS, TLC and MSU. There is a direct link of this work to the Malawi team. The project will share data and lessons learned with the MSU partner to be able to do a more holistic assessment of improved maize-legume systems in the region. | | |
|  | | |

9. Gantt chart

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Activity** | **2019** | | | **2020** | | | | | | | | |
| **Oct** | **Nov** | **Dec** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** |
| Planning and contracting |  |  |  |  |  |  |  |  |  |  |  |  |
| Development of subgrants with partners |  |  |  |  |  |  |  |  |  |  |  |  |
| Procurement of inputs |  |  |  |  |  |  |  |  |  |  |  |  |
| Trial implementation |  |  |  |  |  |  |  |  |  |  |  |  |
| Selection of sites for MSc study |  |  |  |  |  |  |  |  |  |  |  |  |
| Monitoring and evaluation |  |  |  |  |  |  |  |  |  |  |  |  |
| Bio-physical data taking |  |  |  |  |  |  |  |  |  |  |  |  |
| Case studies |  |  |  |  |  |  |  |  |  |  |  |  |
| Socio-economic surveys |  |  |  |  |  |  |  |  |  |  |  |  |
| Field and study tours to target communities |  |  |  |  |  |  |  |  |  |  |  |  |
| Student supervision |  |  |  |  |  |  |  |  |  |  |  |  |
| Writing of bi-annual report |  |  |  |  |  |  |  |  |  |  |  |  |
| Field days and evaluation meetings |  |  |  |  |  |  |  |  |  |  |  |  |
| Collection of field data |  |  |  |  |  |  |  |  |  |  |  |  |
| Analysis of field data |  |  |  |  |  |  |  |  |  |  |  |  |
| Evaluation meetings in country |  |  |  |  |  |  |  |  |  |  |  |  |
| Data upload into Dataverse |  |  |  |  |  |  |  |  |  |  |  |  |
| Africa RISING meeting |  |  |  |  |  |  |  |  |  |  |  |  |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Outcome 2: Natural resource integrity and resilience to climate change enhanced for the target communities and agro-ecologies | | | | | | | | | | | |
| Output 2.2 | | | Innovative options for soil, land and water management in selected farming systems demonstrated at strategically located learning sites | | | | | | | | |
| Activity 2.2.1 | | | Set up demonstration and learning sites in target ESA communities | | | | | | | | |
| Sub-activity 2.2.1.2 | | | Investigations on nutrient and water management for climate resilience along a climate gradient in southern Malawi | | | | | | | | |
|  | | | | | | | | | | | |
| d. Research team | | | | | | | | | | | |
| Name | | | | Institution | | Role | | | | | |
| Regis Chikowo, Sieg Snapp | | | | MSU | | PIs, lead overall work | | | | | |
| Julius Manda | | | | IITA | | Conduct economic analysis on the profitability of different options | | | | | |
| Gundula Fischer | | | | IITA | | Provide appropriate methodologies for gender analysis, depending on local context | | | | | |
| N.N. | | | | IITA/IFPRI | | M&E | | | | | |
|  | | | | | | | | | | | |
| e. Student(s): NIL | | | | | | | | | | | |
|  | | | | | | | | | | | |
| f. Location(s) | | Linthipe, Kandeu, Mtubwi, Nsanama, Nyambi, Extension Planning Areas (EPAs) | | | | | | | | | |
|  | | | | | | | | | | | |
| g. Start date | | October 2016 | | | | | | | | | |
|  | | | | | | | | | | | |
| h. End date | | September 2020 | | | | | | | | | |
|  | | | | | | | | | | | |
| 1. Justification | | | | | | | | | | | |
| In much of Africa, seasonal rainfall predictions are often generalized, limiting their usefulness in practically guiding responsive management on the farms, including choice of appropriate cropping regimes that best-fit expected rainfall quality. Therefore, farmers are exposed to climatic risk in environments with high inter- and intra-season rainfall variability, making fertilizer investments unattractive. Simple approaches to buffer farmers against soil moisture stresses are required. Over the past 5 years, we have demonstrated to over 3,000 farmers how they could reduce the intensity of drought-related shocks through in- situ water conservation. We have set up more than 15 demonstration sites in 7 Extension Planning Areas and held training workshops with extension staff and other stakeholders. We have shown that in-situ storage of rainwater that comes as high-intensity storms, through tied-ridges, is effective at reducing erosion and increasing the proportion of rainwater that infiltrates. Over the past few years (2016-2019), Malawi has already experienced both extreme ends of weather patterns, droughts and flooding.  Achievement against output: During drought years, our research has shown significant productivity gains in crops and better fertilizer use efficiencies. For example, with fertilizer alone, maize grain yields were an average of 2,740 kg/ha over 5 sites. However, with fertilizer and tied ridges, maize grain yields increased to 3,989 kg/ha. We estimate that 10% of the farmers in Machinga District are already integrating tied ridges, being especially from drought-prone areas. This work underpins the building of resilience under variable rainfall conditions. | | | | | | | | | | | |
|  | | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | | |
| 2.1 The main objective is to quantify the benefits of integrated nutrient and water management through simple in-situ tied ridges water harvesting techniques. Tied ridges store excess water and increase the residence time for rainwater to infiltrate and reduce runoff and erosion. To investigate the interactions between rainfall received, nutrient management and soil type, we will set up two on-farm experiments for each of three agro-ecologies (sites) in Machinga district, Southern Malawi. | | | | | | | | | | | |
|  | | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | | |
| 3.1 Does in-situ water harvesting through tied ridges result in better nutrient use efficiencies across sites? | | | | | | | | | | | |
| 3.2 What are the unique niches for this practice? (soils, rainfall season quality) | | | | | | | | | | | |
|  | | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | | |
| Experiment design, implementation and data analysis:  To investigate the interactions between rainfall received, nutrient management and soil type, we will set up two on-farm experiments for each of three agro-ecologies (sites) in Machinga District, Southern Malawi. Main plot factor will be water management (tied or no-tied ridges) while sub-plots factors are NP management and cropping sequencing: 1) continuous non-fertilized maize, 2) maize fertilized at 35 or 70 kg N ha-1 [N-35 or N-70], 3) sole groundnut or a groundnut/pigeon pea intercrop, both sequenced with maize in Years 2 and 3.   1. Maize– control 2. Maize – control with tied ridges (with TR) 3. Maize + fertilizer (full rate NP) (continuous maize every year) 4. Maize + fertilizer (full rate NP) with TR (continuous maize every year) 5. Groundnut (half-rate NP) 6. Groundnut (half-rate NP)-with TR 7. Groundnut + pigeon pea (half-rate NP) (Year two maize) 8. Groundnut + pigeon pea with TR (half-rate NP) (Year two maize) with TR 9. Maize + fertilizer (half-rate NP) 10. Maize + fertilizer (half-rate NP) with TR   Tied ridges management.   1. Tied ridges will be made at planting time to capture as much rainwater as possible 2. Flexible ridge management: ridge ties must be broken during flooding periods (when there are continuous rains for over 7 days) | | | | | | | | | | | |
|  | | | | | | | | | | | |
| 5. Data (with metrics) to be collected and uploaded on Dataverse | | | | | | | | | | | |
| Domain & *Indicator* | Field/plot level metrics | | | | Farm level metrics | | Household level metrics | | Community /landscape metrics | Measurement method | |
| Productivity | | | | | | | | | | | |
| *Maize grain productivity* | Maize grain and biomass yield (kg/ha/season); | | | | Maize production (kg/ha/season) | |  | |  | Yield measurements | |
| *Legume productivity* | Soybean/groundnut grain and biomass yield (kg/ha/season); | | | |  | |  | |  | Yield measurements | |
| *Yield gap* | Yield gap for maize, soybean, groundnuts (kg/ha/season) | | | |  | |  | |  | Yield measurements | |
| Economic | | | | | | | | | | | |
| *Profitability* | Net income ($/crop/ha/season); Gross margin | | | |  | |  | |  | Survey | |
| *Labor requirement* |  | | | |  | | Farmer rating of labor | |  | Farmer evaluation | |
| Environmental | | | | | | | | | | | |
| *Water availability* | % of plants wilting | | | |  | |  | |  | Survey; participatory exercise | |
| *Erosion* | Rating of soil erosion | | | |  | |  | |  | Participatory exercise | |
| Human condition | | | | | | | | | | | |
| *Nutrition* | Protein production (g/ha) | | | |  | |  | |  | Lookup tables | |
| *Food security* | Food production  (calories/ha/year) | | | |  | | Months of food insecurity | |  | Survey | |
| Social | | | | | | | | | | | |
| *Gender equity* | Rating of technologies by gender | | | |  | |  | |  | Participatory evaluation | |
| *Social cohesion* |  | | | |  | |  | | Social groups | Key informant interviews | |
|  | | | | | | | | | | | |
| 6. Deliverables | | | | | | | | Means of verification | | | Delivery date |
| 6.1 Field protocols updated and available | | | | | | | | Field protocols | | | Jan. 2020 |
| 6.2 At least one nutrient x water management trial established per EPA | | | | | | | | Field trials established | | | Jan. 2020 |
| 6.3 Field days held with partners | | | | | | | | Field day reports | | | May 2020 |
| 6.4 Soil water and nutrients use interactions assessed | | | | | | | | Draft publication | | | Sep. 2020 |
| 6.5 At least 10,000 farmers practicing tied ridges across projects sites (District Agriculture Extension Coordination Committees disseminating technology beyond Africa RISING project sites) | | | | | | | | DAECC reports/feedback  Ft database | | | Sep. 2020 |
|  | | | | | | | | | | | |
| 7. How will scaling be achieved? | | | | | | | | | | | |
| * Malawi extension system mainstreaming activities in different districts; Total Land Care and other NGOs will be exposed to the technology for possible scaling; CIMMYT has direct interests in maize intensification and can potentially scale this to other districts (and countries); * at least 10,000 smallholder farmers practicing water conservation practices | | | | | | | | | | | |
|  | | | | | | | | | | | |
| 8. How are the activities in this protocol linked to those of others? | | | | | | | | | | | |
| CIAT mainstreaming water management in common bean intensification (Sub-activity 3.2.1.2) water management technologies also being implemented in Africa RISING Tanzania.  CIMMYT uses CA as a strategy for increasing soil water availability to improve crop productivity (Sub-activity 5.1.1.1). This objective is core to this sub-activity. | | | | | | | | | | | |
|  | | | | | | | | | | | |
| 9. Gantt chart | | | | | | | | | | | |
| See sub-activity 1.1.1.2 | | | | | | | | | | | |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Outcome 2: Natural resource integrity and resilience to climate change enhanced for the target communities and agro-ecologies | | | | | | | | | | |
| a. Output 2.2 | | | Innovative options for soil, land and water management in selected farming systems demonstrated at strategically located learning sites | | | | | | | |
| b. Activity 2.2.1 | | | Set up demonstration and learning sites in target ESA communities | | | | | | | |
| c. Sub-activity 2.2.1.3 | | | Test climate-smart farming practices (tied ridges, weather-informed varieties, cover crops integration [cowpea, medium duration pigeon pea]) for increasing productivity of maize-legume system under variable weather conditions | | | | | | | |
|  | | | | | | | | | | |
| d. Research team | | | | | | | | | | |
| Name | | Institution | | | Role | | | | | |
| Job Kihara | | CIAT | | | PI | | | | | |
| District staff | | MoA | | | Organize field days and supervise field operations by farmers | | | | | |
| N.N. | | ESA M&E Officer & Data Manager | | | To provide support in monitoring of the research activities to ensure compliance with the FtF monitoring system including periodically assisting in data collection (both FtF and Custom indicators data) with critical gender perspective and uploading into the FtF system | | | | | |
|  | | | | | | | | | | |
| e. Student(s): NIL | | | | | | | | | | |
|  | | | | | | | | | | |
| f. Location(s): | | Sabilo and Gallapo in Babati District | | | | | | | | |
|  | | | | | | | | | | |
| g. Start date | | Dec. 2016 | | | | | | | | |
|  | | | | | | | | | | |
| h. End date | | Nov. 2020 | | | | | | | | |
|  | | | | | | | | | | |
| 1. Justification | | | | | | | | | | |
| Farmers continue to face challenges related to weather variability in crop production. In Babati, the 2015-16 cropping season, for example, resulted in large losses in productivity. Also, farmers expressed the need for climate-smart technologies during a stakeholder needs assessment before Phase-2 of Africa RISING (progress reports by Kihara). Various opportunities exist to address the rainfall variability challenges. One option is to utilize weather forecasts information in making decisions on planting dates. While such information is being relayed and now at the click of phone gadgets, it is not clear how such information will improve production relative to conventional farmer planting timing. Other opportunities of addressing challenges of rainfall variability include the integration of in situ water harvesting, cover crops and improved fertilizer management. This research addresses the response of crops to the combined application of these technologies. Besides the known benefit of undertaking such assessments for at least 2 seasons, it is important that farmer experiences and household dynamics are considered when introducing a new technology. For this, farmers are exposed to the technology for at least 2 seasons. This study is done for one season and is now moving to the second season. | | | | | | | | | | |
|  | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | |
| 2.1 To assess the effects of different climate-smart farming practices on productivity of maize and pigeon pea | | | | | | | | | | |
| 2.2 To determine gender-related social constructs related to implementation of selected climate-smart farming practices (for 2019/2020 season) | | | | | | | | | | |
|  | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | |
| 3.1 To what extent do tied ridges affect productivity in different ecozones and weather variability in Northern Tanzania? | | | | | | | | | | |
| 3.2 To what extent is crop diversification an option for improving resilience under climate variability? | | | | | | | | | | |
| 3.3. What are the gross margins associated with selected climate-smart agricultural practices in northern Tanzania? | | | | | | | | | | |
|  | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | |
| Experiment design, implementation and data analysis:  The experiment is laid out as a randomized complete block design with 7 treatments (described in the research protocol). In each field, each treatment is replicated 3 times. Treatment plot sizes are 7m x 5m. The net plot used for measurements of grain and biomass will leave out 1 m from each side of the plot to reduce border effects. In all treatments, two maize seeds will be planted at a spacing of 25 × 75 cm, and later thinned to one, to attain a plant population of 53,333 plants per hectare. Pigeon pea and beans are planted to also attain similar densities across plots. | | | | | | | | | | |
|  | | | | | | | | | | |
| 5. Data (with metrics) to be collected and uploaded on Dataverse | | | | | | | | | | |
| Domain & *Indicator* | Field/plot level metrics | | | Farm level metrics | | Household level metrics | | Community/landscape metrics | Measurement method | |
| Productivity | | | | | | | | | | |
| *Crop productivity* | *Maize, beans, pigeon pea and cowpea productivity* (Kg/ha/  season) | | |  | |  | |  | *Yield measurements* | |
| *Variability of production* |  | | |  | | Rating of production risk | |  | *Farmer evaluation* | |
| *Biomass productivity* | Maize, beans, pigeon pea and cowpea biomass productivity (kg/ha/  season) | | |  | |  | |  | *Yield measurements* | |
| Residue production (kg/ha/  season) | | |  | |  | |  | *Yield measurements* | |
| Rating of residue production | | |  | |  | |  | *Farmer evaluation* | |
| Economic | | | | | | | | | | |
| *profitability* *and labor requirements* | Gross margins ($/crop/ha/ season) | | |  | |  | |  | Participatory evaluation | |
| *Labor requirement* | Labor requirement (hours/ha) | | |  | | Farmer rating of labor | |  | Farmer evaluation | |
| *Variability of profitability* |  | | |  | | Probability of low profitability | |  | Farmer evaluation | |
| Environment | | | | | | | | | | |
| *Fuel availability, soil* | Fuel biomass (kg/ha/season) | | |  | |  | |  | Participatory exercise | |
| *Soil physical quality* | Infiltration rate | | |  | |  | |  | Soil tests | |
| Human condition | | | | | | | | | | |
| *Nutrition* | Protein production (g/ha) | | |  | |  | |  | Lookup tables | |
| *Food security* | Food production (Calories/ha/year) | | |  | | Months of food insecurity; Rating of food security | |  | Field measurement/ lookup tables | |
| Social | | | | | | | | | | |
| *Gender equity* |  | | |  | | Time allocation by gender | |  | Key informant interviews | |
|  | | |  | | Management control by gender | |  | Key informant interviews | |
| Income by gender | | |  | | Income by gender | |  | Key informant interviews | |
| Rating of technologies by gender | | |  | | Rating of technologies by gender | |  | Key informant interviews | |
| Food security by gender | | |  | | Food security by gender | |  | Key informant interviews | |
| *Equity (generally)* |  | | |  | | Rating of technologies by group | |  | Focus group discussions (for farmers hosting trials) | |
|  | | | | | | | | | | |
| 6. Deliverables | | | | | | | Means of verification | | | Delivery date |
| 6.1 Four on-farm trials, 2 in each of 2 eco-zones, successfully Implemented | | | | | | | Research reports | | | Oct. 2020 |
| 6.2 Two new technologies being tested | | | | | | | Research reports | | | Oct. 2020 |
| 6.3 Thirty farmers trained | | | | | | | Training report | | | Aug. 2020 |
| 6.4 Soil moisture and SPAD data uploaded | | | | | | | Research reports | | | Nov. 2020 |
|  | | | | | | | | | | |
| 7. How will scaling be achieved? | | | | | | | | | | |
| We developed a field guide that shows different best agronomic practices including aspects of climate-smart technologies. We will also demonstrate to extension and development partners the performance of the technologies both in the field and using data collected for season 1. We are currently partnering with Meru Agro Seed Company to deliver improved maize seeds and provide advice to farmers. We will link up with World Vision and with COSITA to potentially utilize Mwanga ICT platform for communicating agronomic information. Besides, farmers already enlisted in Mwanga will receive agronomic messages. | | | | | | | | | | |
|  | | | | | | | | | | |
| 8. How are the activities in this protocol linked to those of others? | | | | | | | | | | |
| Field level data from this activity will feed into farm-level farming systems work led by Lieven Claessens The micro-catchments and associated soil moisture measurements will complement assessments being undertaken in Kongwa-and Kiteto sites. We are utilizing Mwanga ICT, a tool developed within Africa RISING. | | | | | | | | | | |
|  | | | | | | | | | | |

9. Gantt chart

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 2019 | 2020 | | | | | | | | | |
| Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct |
| Input acquisition, Field marking, Planting trials and babies |  |  |  |  |  |  |  |  |  |  |  |
| Cover crop relaying in mother trials and babies & top dressing |  |  |  |  |  |  |  |  |  |  |  |
| Protocol development, partner training & reporting |  |  |  |  |  |  |  |  |  |  |  |
| Technology rating |  |  |  |  |  |  |  |  |  |  |  |
| Bean harvesting and 2nd top dressing |  |  |  |  |  |  |  |  |  |  |  |
| Plant chlorophyll measurements |  |  |  |  |  |  |  |  |  |  |  |
| Maize harvesting, drying and yield determination |  |  |  |  |  |  |  |  |  |  |  |
| Weeds & pest diseases control |  |  |  |  |  |  |  |  |  |  |  |
| Pigeon pea harvesting and soil water infiltration test & conducting FGD |  |  |  |  |  |  |  |  |  |  |  |
| Soil moisture measurements, Weather data monthly downloads & handling |  |  |  |  |  |  |  |  |  |  |  |
| Seasonal data analysis, dataverse publishing and end of year reporting |  |  |  |  |  |  |  |  |  |  |  |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Outcome 2: Natural resource integrity and resilience to climate change enhanced for the target communities and agro-ecologies | | | | | | | | | |
| a. Output 2.2 | | | Innovative options for soil, land and water management in selected farming systems demonstrated at strategically located learning sites | | | | | | |
| b. Activity 2.2.1 | | | Set up demonstration and learning sites in target ESA communities | | | | | | |
| c. Sub-activity 2.2.1.4 | | | Land rehabilitation through integration of fodder trees and grass forage species in dryland farming | | | | | | |
|  | | | | | | | | | |
| d. Research team | | | | | | | | | |
| Name | | Institution | | | Role | | | | |
| Anthony. Kimaro | | ICRAF | | | PI, Research design and oversight of project activities | | | | |
| Emmanuel Temu | | ICRAF | | | Data collection for the economics, social, human condition domains | | | | |
| Lieven Claessens | | IITA | | | Farming system research and technical backstopping | | | | |
| Julius Manda | | IITA | | | Contributing to economic analyses of contours | | | | |
| Mawazo Shitindi | | SUA | | | Contributing to the evaluation of land rehabilitation benefits of contours | | | | |
| Frances Muthoni | | IITA | | | Mapping priority sites for targeting land rehabilitation practices | | | | |
| IFPRI | | IFPRI | | | Monitoring of the research activities to ensure compliance with the FtF monitoring system | | | | |
|  | | | | | | | | | |
| e. Student(s): Nil | | | | | | | | | |
|  | | | | | | | | | |
| f. Location(s): | | Mlali village in Kongwa District | | | | | | | |
|  | | | | | | | | | |
| g. Start date | | October 2014 | | | | | | | |
|  | | | | | | | | | |
| h. End date | | September 2020 | | | | | | | |
|  | | | | | | | | | |
| 1. Justification | | | | | | | | | |
| Arid and semi-arid areas experience high shortages of biomass for cooking energy due to limited supply from the native forests and woodland coupled with high harvesting pressure of wood for fuelwood, construction materials, and other wood products, resulting into acute shortages of cooking energy. To cope with this problem, farmers in Kongwa and Kiteto districts use crop residues and livestock manure as a source of cooking energy. Crops residues in these districts also have competing demands for livestock feeds (both free and zero-grazing). Moreover, the use of crop residues for energy and/or livestock feeds accelerates land degradation and nutrients depletion because it reduces soil cover and disrupts the nutrient cycling processes. To mitigate these challenges ICRAF and partners promoted landscape-based approaches for sustainable land management, including contour farming. The approach is in line with the resolution of the pre-planning meeting in Arusha to adopt farm-based case studies to effectively integrate farming system research in the Africa RISING program. Activities on Moshi Maile’s contour site started in 2014 with the construction of contours followed by the planting of fodder grass and trees to stabilize contour bunds and to supply feeds and fuelwood. The site has been under the management of TARI-Hombolo, the leading partner for soil and water conservation research in Kongwa and Kiteto district. ICRAF started tracking growth and yields of fodder trees and wood the during 2017 season as at least 3 seasons are needed for *G. sepium* to establish (Sub-activity 1.1.1.5). Early growth of diameter (33.6 cm) and height (2.26 m) of *G. sepium* on contours was a comparatively higher on contours compared to intercropped trees in the fields (ICRAF research reported in 2017 through ICRISAT). Yields of fodder grass (Guatemala) and maize yields were also measured in 2018 and 2019 seasons and the preliminary results for 2018 were included in chapter 4 of the Africa RISING technology handbook. Maize yields from 18 geo-referenced fields of Africa RISING farmers (the farmer practice) in 2017 were used as a baseline to assess the impacts of contours. We noted that maize grain yield in the upland site (3.4t/ha) and lowland (3.2t/ha) contour sites were similarly based on the T-test analysis. Relative to the baseline (1.04t/ha), contours improved maize grain yield by over 200% during the 2018 cropping season. But grain yields in the upper sites were very low (0.83t/ha) while no yield was obtained in the lowland site during the 2019 season. These results reflect the drought-induced crop failure due to low and poorly distributed rainfall patterns in 2019 as noted by the prolonged drought spell (Mid-February to April 7). However, analysis of economic benefits revealed the importance of crop diversification on contours in enhancing food security and the adaptive capacity of farmers. Fodder and wood supply from forage crops were less affected by drought and hence contributed to higher gross margins (381-471 USD/ha) and returns to labor (349-564USD/ha) in contours compared to the farmer practice (216 USD and 311 USD/ha). The percentage of income derived from maize was 52% in 2018 but it declined to 27% in 2019. The corresponding values for *G. sepium* wood-based income in 2019 was 76.3%, the season with poor maize yield. Gross income from Guatemala fodders was steady over the two growing seasons, averaging USD 35.09 per month. Diversified and steady income sources from this farm demonstrate the potential for contour farming to increase the purchasing power and access to food during the period of short supply and contribute to enhancing the climate-change adaptive capacity of farmers. The jumpstart research in Kongwa and Kiteto districts suggests that only 46% of households can produce food which can sustain a family for 3-6 months (Kimaro *et al*., 2012[[19]](#footnote-19)). Assessment of land rehabilitation benefits, including a nutrient budget, of this technology has just started with support from SUA and it will continue in 2020 to demonstrate the impact of the technology on soil erosion control and land productivity. It is, therefore, necessary to continue with the assessment of crops (maize and fodder yields) in contour protected sites to collect data to inform this study.  Both the country pre-planning meeting and the pre-implementation field meeting in Kongwa identified data gaps in the economics, social, and human condition domains which are required for a comprehensive analysis of the sustainability of contour using the SIAF manual (Musumba *et al*, 2017[[20]](#footnote-20)). This sub-activity will also provide information on the resilience arising from contours as identified during the pre-implementation meeting and included in the ISFM sub-activity 2.2.1.3. As noted above, preliminary work on economic analyses of contours at Moshi Maile farm was conducted in 2019 using data collected in 2018 and 2019 growing seasons. However, more work is needed on the social and Human condition indicators and this will also be the focus of the current workplan. | | | | | | | | | |
|  | | | | | | | | | |
| 2. Objectives | | | | | | | | | |
| 2.1 To assess the effects of contour farming on crop yields and household energy security | | | | | | | | | |
| 2.2 To determine soil fertility and other land rehabilitation benefits of contour farming | | | | | | | | | |
| 2.3 To evaluate impacts of contour farming and fodder crops integration on the economics, social and human condition SI domains to fill the data gaps for assessment of the sustainability of the technology using the SIAF manual | | | | | | | | | |
|  | | | | | | | | | |
| 3. Research questions | | | | | | | | | |
| 3.1 How does the introduction of contour farming stabilised with fodder trees and grass forage species contribute to sustainable intensification in dryland farming? | | | | | | | | | |
|  | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | |
| Experiment design, implementation and data analysis:  Farm-based case study consisting of two sites, the lowland site and upland site, where farmer Moshi Maile constructed contours following training by TARI-Hombolo. There are six contours on the upland sites and three on the lowland site. Contour bands are re-enforced with Guatemala grass planted at a spacing of 1x1m and *G. sepium* planted at a spacing of 3x3m to produce fodder and stabilize the bunds. The farmer does not keep livestock but sales the fodder and/or exchange with manure which is applied on the contour sites. Data on manure inputs and nutrient added is being collected by SUA as part of the nutrient budget study for this site. At the onset of each season, the site is prepared, and maize (variety Staha) plated as detailed in the attached protocol. The farmer is also involved in collecting data on Guatemala fodder yields by recording the number of calibrated bags harvested in a data book provided by ICRAF. Africa RISING researchers (ICRAF and SUA staff) sample maize and soil to estimate crop productivity and soil retention in contour protected sites as detailed in the protocol section 2. Data on the profile of farmers hosting demonstration plots, crop management history, farm operation costs, farmgate price of produce, household food sufficiency and SI domain indicators will be obtained by interviewing the farmers using a checklist to be developed as detailed in section 4 of the attached protocol. | | | | | | | | | |
|  | | | | | | | | | |
| 5. Data to be collected and uploaded on Dataverse | | | | | | | | | |
| Domain & *Indicator* | Field/plot level metrics | | | Farm-level metrics | | | Household-level metrics | Measurement method | |
| Productivity | | | | | | | | | |
| *Crop productivity* |  | | | Yield (kg/ha/season) | | |  | Yield measurement | |
| *Biomass productivity* |  | | | Yield (kg/ha/season) | | |  | Yield measurement | |
| Environmental | | | | | | | | | |
| *Fuel availability* |  | | | Biomass (t/ha) | | | No of energy security months | Biomass measurement | |
| *Soil biology* |  | | | Labile carbon (g/kg) | | |  | Soil test by SUA | |
| *Soil chemical*  *Quality* |  | | | Soil pH (acidity), Soil nutrient levels (g/kg) and EC (cmol/kg) | | |  | Soil test by SUA | |
| *Soil physical*  *Quality* |  | | | Bulk density (g/cm3) | | |  | Soil test by SUA | |
| *Erosion* |  | | | Soil loss (contours, t/ha/yr) | | |  | Soil measurement by SUA | |
| Economic | | | | | | | | | |
| *Profitability* |  | | | Gross margin (USD/ha) | | |  | Checklist to collect data on field operation costs and farmgate price | |
| *Returns to land* |  | | | Returns (USD/ha) | | |  | Same as above | |
| *Labor requirement* |  | | | Labor requirement (hrs/ha) | | |  | Checklist/farmer recall of labor inputs for various operations | |
| Social | | | | | | | | | |
| *Gender equity* | N/A | | |  | | |  |  | |
| *Equity* | N/A | | |  | | |  |  | |
| Human conditions | | | | | | | | | |
| *Nutrition* |  | | | Protein production (g/ha) | | |  | Conversion using Lookup tables | |
| *Food security* |  | | | Food production (calories/ha) | | |  | Conversion using Lookup tables | |
| *Capacity to*  *Experiment* |  | | |  | | | # of new practices being tested | Inventory of Africa RISING technologies in the farm | |
|  | | | | | | | | | |
| 6. Deliverables (Name of institution responsible is indicated in the brackets except for ICRAF deliverables) | | | | | | Means of verification | | | Delivery date |
| 6.1 Farmer field day for knowledge sharing | | | | | | Technical and FFD reports | | | Jul. 2020 |
| 6.2 Data on the benefits of contour farming in terms of improved crop productivity and income and a manuscript on household cooking energy security | | | | | | Technical report and the manuscript developed | | | Sep. 2020 |
| 6.3 Crop yield (maize, Guatemala grass), fuelwood and economic data generated to contribute to system research | | | | | | Datasheets and uploads on Dataverse | | | Sep. 2020 |
| 6.4 Data on soil quality effects of contours (SUA-Shitindi) | | | | | | Technical report and data uploads on Dataverse | | | Sep. 2020 |
| 6.5 Maps of priority sites for land rehabilitation (IITA-Francis) | | | | | | Technical report | | | Sep. 2020 |
| 6.6 Success story on farmer-led technology scaling | | | | | | Africa RISING website | | | Sep. 2020 |
|  | | | | | | | | | |
| 7. How will scaling be achieved? | | | | | | | | | |
| Scaling will be through knowledge sharing during the FFD to potential adopters of contour farming, including farmers that host Gliricidia intercropping plots under Sub-activity 1.1.1.5 and farmers from the scaling site of Ngumbi and villages under the collaboration between LEAD Foundation and TARI-Hombolo who have shown interest in integrating fodder trees on their contours. The success story to be developed will also inform the scaling process and impacts of the technology to adopters. | | | | | | | | | |
|  | | | | | | | | | |
| 8. How are the activities in this protocol linked to those of others? | | | | | | | | | |
| This sub-activity is directly linked to the following sub-activities:   * Sub-activity: 1.3.1.2: Produce regionally relevant extrapolation domain maps for validated soil and water conservation practices (IITA-Francis Muthoni; by providing current and historical data of maize, soil nutrients and fertilizer response trials needed for simulations)   Sub-activity 2.2.1.3: Evaluating potential contributions of integrated soil fertility management around the five SIAF domains with emphasis on Africa RISING interventions in Tanzania: data on crop and fodder yields, wood supply and economics to be generated in 2020 will contribute to this system-wide ISFM activity and the system research led by Lieven Claessens. Also, data on crop and biomass yields and economics analyses for previous seasons is available for this sub-activity. | | | | | | | | | |
|  | | | | | | | | | |

9. Gantt chart

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **S/No** | **Description of Activity** | **2019** | | **2020** | | | | | | | | |
| **Nov** | **Dec** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sept** |
| 1 | Site preparations and re-establishment of trials |  |  |  |  |  |  |  |  |  |  |  |
| 4 | Crop management (weeding, fertilizer, disease control) |  |  |  |  |  |  |  |  |  |  |  |
| 5 | Data collection for APSIM modelling by ICRISAT |  |  |  |  |  |  |  |  |  |  |  |
| 6 | Collection of data for social, economic and human condition domains |  |  |  |  |  |  |  |  |  |  |  |
| 7 | Rainout shelter re-installation at Manyusi |  |  |  |  |  |  |  |  |  |  |  |
| 8 | Biophysical data collection (maize grain and wood yield) |  |  |  |  |  |  |  |  |  |  |  |
| 9 | Attend farmer field day and Nane-nane exhibition |  |  |  |  |  |  |  |  |  |  |  |
| 10 | Collect pigeonpea data (grain & wood) |  |  |  |  |  |  |  |  |  |  |  |
| 11 | Laboratory analysis of soil and plant samples |  |  |  |  |  |  |  |  |  |  |  |
| 12 | Data processing, analysis and archiving |  |  |  |  |  |  |  |  |  |  |  |
| 13 | Writing reports and manuscripts |  |  |  |  |  |  |  |  |  |  |  |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Outcome 2: Natural resource integrity and resilience to climate change enhanced for the target communities and agro-ecologies | | | | | | | |
| a. Output 2.2 | | | Innovative options for soil, land and water management in selected farming systems demonstrated at strategically located learning sites | | | | |
| b. Activity 2.2.1 | | | Set up demonstration and learning sites in target ESA communities | | | | |
| c. Sub-activity 2.2.1.5 | | | Evaluation of land rehabilitation benefits of shelterbelts and contours | | | | |
|  | | | | | | | |
| d. Research team | | | | | | | |
| Name | | Institution | | Role | | | |
| Mawazo J. Shitindi | | SUA | | Lead researcher coordinating sampling processes and overseeing laboratory analysis and research report production. | | | |
| Anthony Kimaro | | ICRAF | | Co-researcher to provide technical backstopping on the design of shelterbelt and contour demo plots, baseline data of soil properties and general classification of soils in the study area. | | | |
| Elirehema Swai | | TARI Hombolo | | Co-researcher to provide technical backstopping on the design of soil-water conservation demo-plots and baseline data of soil properties in the study area before initiation of contour bunds. | | | |
| IFPRI | | IFPRI | | To provide support in monitoring of the research activities to ensure compliance with the FtF monitoring system including periodically assisting in data collection (both FtF and Custom indicators data) with critical gender perspective and uploading into the FfF system. | | | |
|  | | | | | | | |
| e. Students: Nil | | | | | | | |
|  | | | | | | | |
| f. Locations | MlaliMolet and Laikala villages of Kongwa district | | | | | | |
|  | | | | | | | |
| g. Start date | Oct. 2017 (Building on what has been done by TARI Hombolo and ICRAF since 2014) | | | | | | |
|  | | | | | | | |
| h. End date | September 2020 for a full project cycle | | | | | | |
|  | | | | | | | |
| 1. Justification | | | | | | | |
| (This study is carried forward from the research year 2018-2019 since it was not finished).  Being part of soil and water management effort, a shelterbelt demonstration site was established in 2014 with three strips of tree rows, each 100 m long, covering the entire field. Similarly, contour farming demonstrations were established in various fields and stabilized with agroforestry trees (G. sepium and a row of G. robusta). In the first three years of demonstration plot establishments, root collar diameter, diameter at breast height (dbh), plant height, and tree survival was measured for estimation of wood and foliage (fodder) biomass yields. In 2018 season data on alley cropped maize, fodder and wood yield were also collected and will continue in 2019 and 2020 to account for seasonal variation and generate data for other SI domains needed to evaluate the sustainability of the shelterbelt technology. Apart from the estimation of wood, foliage (fodder) biomass and alley cropped maize, land rehabilitation benefits of the shelterbelts have not been established and form the basis for this study. | | | | | | | |
|  | | | | | | | |
| 2. Objectives | | | | | | | |
| To evaluate land rehabilitation benefits (soil erosion control and soil fertility restoration) of shelterbelt and contour farming. | | | | | | | |
|  | | | | | | | |
| 3. Research questions | | | | | | | |
| 3.1 How does soil erosion control and soil fertility restoration by shelterbelts and contour farming contribute to land rehabilitation? | | | | | | | |
|  | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | |
| Experiment design, implementation and data analysis:  Evaluation of land rehabilitation benefits of shelterbelts and stabilized contours will involve analysis of key physical, chemical and biological properties of soil influencing its fertility status. Physical properties to be studied will include soil depth, bulk density, soil texture, and soil moisture characteristics (hydraulic conductivity). Soil chemical properties to be studied will include soil pH, organic carbon (OC), total N, NH4+ -N, extractable P, SO4 – S, Exchangeable cations (Ca, Mg, K and Na), cation exchange capacity (CEC), and DTPA extractable micronutrients (Zn, Fe, Cu and Mn). Biological properties such as microbial populations and activities, microbial biomass and activities of soil enzymes are equally important to assess changes in soil quality as influenced by shelterbelt technology. | | | | | | | |
|  | | | | | | | |
| 5. Data (with metrics) to be collected and uploaded on Dataverse | | | | | | Responsible institution | |
| Productivity:  Crop yields (t/ha) of grain and stover of wood | | | | | | ICRAF/SUA | |
| Environmental:  Nutrient availability (mg/kg soil); Soil carbon (g/kg soil); Nutrient input through litter fall; soil loss kg/ha/year); nutrient uptake and nutrient exported out of the fields (kg/ha) and reduced soil loss (kg/ha) | | | | | | SUA | |
| Economic:  The profitability of technology (gross margin in USD/ha); Cost-Benefit ratio (USD/USD). | | | | | | IITA | |
| Social:  Farmers perceptions of the environmental and economic benefits of the shelterbelt and contours (Numbers by gender and age groups); returns on labor investment (USD/person day) | | | | | | IITA | |
|  | | | | | | | |
| 6. Deliverables | | | | | Means of verification | | Delivery date |
| 6.1 Research protocol developed | | | | | Submitted research protocol | | Dec. 2018 |
| 6.2 Soil and plant sampling conducted for laboratory analysis | | | | | Soil and plant samples registered in the laboratory | | Jan. 2020 |
| 6.3 Laboratory analyses conducted and data sets for the first year (2018/2019) uploaded | | | | | Data sets uploaded and report on land rehabilitation benefits of shelterbelts and contours | | Aug. 2020 |
| 6.4 Assessed soil erosion control benefits of contours and shelterbelts and linked to land rehabilitation processes and socio-economic benefits of the technologies | | | | | Annual report | | Aug. 2020 |
|  | | | | | | | |
| 7. How will scaling be achieved? | | | | | | | |
| Development partner interested in this activity will also be thought to help in taking it to scale and partnership with DAICOs to disseminate the technology using demonstration plots and extension materials. | | | | | | | |
|  | | | | | | | |
| 8. Linkage of activities in this protocol to those of others | | | | | | | |
| Agronomic practices (ICRAF); Shelterbelts and contours evaluated for land rehabilitation benefits are currently part of studies on integrating fodder tree and grass forage species in dryland farming (ICRAF) and S&WC (TARI Hombolo). | | | | | | | |

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| Outcome 2: Natural resource integrity and resilience to climate change enhanced for the target communities and agro-ecologies | | | | | | | | | | |
| a. Output 2.2 | | | Innovative options for soil, land and water management in selected farming systems demonstrated at strategically located learning sites | | | | | | | |
| b. Activity 2.2.1 | | | Set up demonstration and learning sites in target ESA communities | | | | | | | |
| c. Sub-activity 2.2.1.6 | | | Validation of residual tied ridging as a labor-saving technology in semi-arid areas of Central Tanzania | | | | | | | |
|  | | | | | | | | | | |
| d. Research team | | | | | | | | | | |
| Name | Institution | | | Role | | | | | | |
| Elirehema Swai | TARI Hombolo | | | PI Research design and oversight of the project activities | | | | | | |
| Edward Mwinuka | University of Dodoma | | | Economic data collection | | | | | | |
| Julius Manda | IITA | | | Economic studies (Refer sub-activity 4.1.1.1 of last year) | | | | | | |
| Gundula Fischer | IITA | | | Gender studies (Refer sub-activity 5.1.7.2) | | | | | | |
|  | | | | | | | | | | |
| e. Students: Nil | | | | | | | | | | |
|  | | | | | | | | | | |
| f. Locations | Laikala, Mlali, Ngumbi and Sagara villages in Kongwa District | | | | | | | | | |
|  | | | | | | | | | | |
| g. Start date | 2016/2017 | | | | | | | | | |
|  | | | | | | | | | | |
| h. End date | September 2021 | | | | | | | | | |
|  | | | | | | | | | | |
| 1. Justification | | | | | | | | | | |
| Introduction and popularization of technologies aiming at reducing drudgery for rural overburdened resource-constrained farming communities is immensely important. Thus, a study on the use of Residual Tied Ridging (RTR) tillage technique as labor-saving technology will be assessed during the 2019/2020 cropping season as a strategy for alleviating the labor bottleneck. The potential benefit behind using RTR technique is that in the first cropping season, high labor input is required for ploughing, and ridge and ridge tie construction. In the subsequent cropping seasons, tied ridges made in the previous season will be maintained (hence residual) and just re-shaped to their original size, ready for planting. Following the study undertaken in Kiteto and Kongwa districts, the use of residual tied ridging was superior over conventional tillage method. Study in Kiteto district revealed that use of RTR technique increased maize grain yield from 556 kg/ha under conventional tillage (CT) to 4,515 kg/ha, which was approximately three times higher than other in situ rainwater harvesting techniques notably rip tillage which produced 1,600kg/ha (Africa RISING Report for Kiteto and Kongwa districts submitted to IITA, Okori 2017). Similarly, during 2017/2018 cropping season, a study undertaken in Kongwa district noted that annually made tied ridges and residual tied ridging (RTR) had yield advantage of 5.3 % and 37.8 % over conventional farmer practice respectively (Africa RISING Report for Kiteto and Kongwa districts submitted to IITA, Okori 2018). In this study, the residual tied ridges technique had yield advantage of 31 % over fresh-made tied ridges (i.e. annually made tied ridges). However, information on soil water storage capacity over time resulting from annual tied ridging, residual tied ridging and conventional tillage in a drought situation at critical stages of maize crop development is indeed lacking as well as economic, social and human condition domains data.  During the 2019/2020 cropping season, three studies will be implemented in Kongwa district to generate data to fill these gaps. Study one will focus on activities which were initiated during the 2018/2019 cropping season which are examining the effects of residual tied ridges on economic factors including costs associated with labor required during land preparation and weeding, crop performance, as well as soil physical and hydrological properties. Study two will be initiated at Mlali village to determine the effects of in situ rainwater harvesting technologies (i.e. ATR and RTR, compared with conventional tillage) under a 100% imposed drought condition. The proposed study is building upon the previous work implemented and it will involve the use of rainout shelter to induce water stress at critical stages of crop development. Study three will generate information at farm level, guided by the systems data gaps identified on Mr. Maile’s farm. | | | | | | | | | | |
|  | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | |
| 2.1 Economic factors, especially costs associated with labor required during land preparation and weeding | | | | | | | | | | |
| 2.2 Crop survival under drought stress | | | | | | | | | | |
| 2.3 Soil physical and hydrological properties | | | | | | | | | | |
|  | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | |
| What biophysical and economic factors distinguish the benefits between residual tied ridges, annually made tied ridges and conventional farmer practice? | | | | | | | | | | |
|  | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | |
| Experiment design, implementation and data analysis:  *Study 1: Validation of residual tied ridging as a labor-saving technology*  The study will be undertaken in four participating villages (Laikala, Mlali, Nghumbi and Sagara) where initial tied ridges were constructed during the 2016/2017 cropping season. Sorghum will be the test crop in the drier Laikala village, and maize in the other three villages. The maize test crop study will also include the comparison between a drought-tolerant variety, WE2109 recently released under the WEMA, and a commercial variety commonly grown by farmers. The experiment design with maize as a test crop will be split-plot, consisting of six treatments that will be replicated three times at each site. All treatments will receive 20kg P/ha and 18kg N/ha as Diammonium Phosphate (DAP) fertilizer at planting and 40 kg N/ha as urea at topdressing. Under the maize test crop system each, participating village (Mlali, Nghumbi and Sagara) will use the same three (3) mother trials used during 2018/2019 as well as the thirty (30) baby trials distributed across the three villages which will be maintained during 2019/2020 cropping season.  The experiment design for the sorghum test crop system is the same as that used during the 2018/2019 cropping season i.e. Split plot Design. The trial consists three tillage methods (i.e. Annual tied ridging (ATR), Residual tied ridging (RTR) and Conventional farmer practice, (CFP), and two improved drought-tolerant sorghum varieties NACO Mtama 1 and Macia (a total of six treatment combinations), replicated three times. Fertilizer application for all treatments will be at the rate of 20kg P/ha and 18kg N/ha of Diammonium Phosphate (DAP) fertilizer at planting, and 40kg N/ha as urea applied as a topdressing. Across the study villages, biophysical and socio-economic data will be collected and analyzed.  *Study 2: Use of rainout shelters to induce water stress for assessing the efficacy of in situ rainwater harvesting methods on crop performance*  The induced drought stress experiment will be initiated at Mlali village, located in central semi-arid Tanzania. The drought study will evaluate the length of time that annual tied ridges (ATR), residual tied ridges (RTR) and conventional tillage (CT) method can conserve water for crop survival. The rainout shelter will be installed in all treatments at the same time after planting, preferably at the flowering stage. Rainout shelters will cover an area of 3m by 3m, will have a height of 2.4 m to 3.4 m and a roof inclination of 18° for precipitation runoff (see research protocol). The rainout shelter will exclude all the ambient rainfall (i.e. 100%) to establish how long a crop can survive under the different treatments. To achieve this, tagging of plants will be done in all treatments after installing the rainout shelter. Photographs of crops from all treatments will be taken after installing the rainout shelter and thereafter at seven days intervals. The series of photographic images taken across treatments will create a comparative photographic progression of crop failure with time. Subsequently, images can be used to estimate the threshold days beyond which the crop cannot recover under the different treatments. Similarly, soil moisture will be measured weekly at the same time with the capture of photographs images in all treatments.  *Study 3: Farm-level data collection for systems analysis*  This study will engage farmer Moshi Maile at Mlali village who is already applying the Africa RISING RWH technologies (both annual tied and residual tied ridging) on his farm beyond experimental plots. The farm-level study was initiated last season (2018/2019) cropping with only one commercial maize variety (DKC 9089) whereby information on maize grain yield and residues was measured. Due to crop failure resulting from the inadequate and high spatial variability of rains during the 2018/2019, a drought maize variety (WE2109) will be introduced as an additional variable. Residual tied ridges installed at spacing of 0.75m between rows will be restored to their shape and size ready for planting. The data to be collected will include crop productivity (grain yields, crop residues), and economics which encompass labor cost and all costs of production. This information will ultimately contribute to the total farm systems analysis.  *Data analysis*   1. Analysis of variance for biophysical variables will be run using Genstat software (Refer sub-activity 2.2.1.6 TARI Hombolo) 2. Gross margin analysis will be conducted to assess the profitability of RTR, annual tied ridging and conventional tied ridging. Results from the gross margin analysis will indicate which tillage method is the most cost-effective and profitable | | | | | | | | | | |
|  | | | | | | | | | | |
| 5. Data to be collected and uploaded on Dataverse | | | | | | | | | | |
| Domain & *Indicator* | | Field/plot level metrics | | | Farm level metrics | | Household level metrics | Community /landscape metrics | | Measurement method (details in research protocol) |
| Productivity | | | | | | | | | | |
| *Crop (maize) productivity* | | Maize grain yield (kg/ha/season) | | | Maize grain yield (kg/ha/season) | |  |  | | Yield measurements |
| *Crop biomass productivity* | | Stover production (kg/ha/season | | | Stover production (kg/ha/season) | |  |  | | Yield measurements |
| Environment | |  | | |  | |  |  | |  |
| *Soil physical quality* | | Soil bulk density (g/cm3) | | |  | |  |  | | Soil test |
| *Water availability* | | Soil moisture content (%), | | | Soil moisture content (%) | |  |  | | Field tests |
|  | | Infiltration, mm | | |  | |  |  | | Field tests |
| Economics (UDOM) | | | | | | | | | | |
| *Profitability* | | Gross margin ($/ha) | | | Gross margin($/ha) | |  |  | | Participatory evaluation |
| *Labor requirement* | | Labor requirement (hours/ha) | | | Labor requirement (hours/ha) | |  |  | | Farmer evaluation |
| *Labor requirement (IITA – Dr Gundula)* | |  | | |  | | Farmer rating of labor |  | | Drudgery scores |
| Human condition | | | | | | | | | | |
| Food security | | Food production (calories/ha/year) | | |  | |  |  | | Lookup tables |
| Social | | | | | | | | | | |
| *Social cohesion* | |  | | |  | |  | Participation in social groups | | Individual interviews |
| *Collective action* | |  | | |  | |  | Collective action groups | |  |
| *Gender equity* | |  | | |  | | Gender preferences |  | | Focus group discussions,  participatory exercises, survey |
|  | | | | | | | | | | |
| 6. Deliverables | | | | | | Means of verification | | | Delivery date | |
| 6.1 At least three mother trials and thirty (30) baby experimental plots established in three villages (Mlali, Nghumbi and Sagara) under maize-based cereal system | | | | | | Progress report | | | Feb 2020 | |
| 6.2 At least one mother trial and ten (10) baby experimental plots established in at Laikala village under sorghum-based cereal system | | | | | | Progress report | | | Feb. 2020 | |
| 6.3 At least 400 farmers and other stakeholders attend farmers’ field day in Kongwa district (TARI Hombolo) | | | | | | Farmers Field Day Report | | | Jul. 2020 | |
| 6.4 Attend at least one stakeholder meeting in Kiteto/Kongwa for sharing of what Africa RISING is implementing in relation to in situ rainwater harvesting and control of soil erosion | | | | | | Meeting report | | | Feb. 2020 | |
| 6.5 Preliminary information on efficacy of in situ rainwater harvesting on imposed drought reported | | | | | | Progress Report | | | Sep. 2020 | |
| 6.6 Information at farm level (i.e. Mr. Moshi Maile) on productivity and economic domains quantified | | | | | | Progress report | | | Sep. 2020 | |
| 6.7 Report on engagement of extension personnel for scaling of in situ rainwater harvesting technologies prepared | | | | | | Progress Reports | | | Mar./Sep. 2020 | |
| 6.8 Data analysis and interpretation | | | | | | Draft manuscript | | | Sep. 2020 | |
|  | | | | | |  | | |  | |
| 7. How will scaling be achieved? | | | | | |  | | |  | |
| The DAICO for Kongwa will be consulted during 2019/2020 cropping season to put in place modalities for engaging extension officers surrounding the Africa RISING villages. It is anticipated that at least 20 extension officers will receive capacity building in RWH 2019/2020 cropping season. Similarly, farmers’ field days (FFD) are an important platform to showcase best practices. The FFD will engage farming communities in the project area as well as neighboring villages for improving decision making about in situ rainwater harvesting technologies. | | | | | | | | | | |
|  | | | | | | | | | | |
| 8. How are activities in this protocol linked to those of others? | | | | | | | | | | |
| The in-situ rainwater harvesting technology is being validated with activity 5.1.3.3 in which SUA assesses the integrative effect of in-situ rainwater harvesting and fertilizer micro-dosing on crop yield, water and nutrient use efficiency in technology Kongwa District. It is linked to sub-activity 4.1.1.1 of last year. Assess the effect of tied ridging, residual tied and rip tillage on maize productivity, net crop returns, household income and food security. It also linked to Sub-activity 5.1.7.2: Gender analysis of soil and water conservation technologies. | | | | | | | | | | |

9. Gantt chart

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Activity** | | **2019** | | | **2020** | | | | | | | | |
| **Oct** | **Nov** | **Dec** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **July** | **Aug** | **Sep** |
| 1 | Conduct feedback meeting with participating farmers in Kongwa District. |  |  |  |  |  |  |  |  |  |  |  |  |
| 2 | Preparation of research materials for trials in Kongwa District |  |  |  |  |  |  |  |  |  |  |  |  |
| 3 | Undertake participatory planning meeting with farmers participated on trials during 2018/2019 cropping season |  |  |  |  |  |  |  |  |  |  |  |  |
| 4 | Land preparation (annual tied ridges and conventional tillage) |  |  |  |  |  |  |  |  |  |  |  |  |
| 5 | Planting of trials in four villages in Kongwa District |  |  |  |  |  |  |  |  |  |  |  |  |
| 6 | Installation of rainout shelter |  |  |  |  |  |  |  |  |  |  |  |  |
| 7 | Management of trials/crop management |  |  |  |  |  |  |  |  |  |  |  |  |
| 8 | Maintain/Restore residual tied ridges at first weeding |  |  |  |  |  |  |  |  |  |  |  |  |
| 9 | Data collection on biophysical variables |  |  |  |  |  |  |  |  |  |  |  |  |
| 10 | Conduct farmer Field days at in Kiteto/Kongwa |  |  |  |  |  |  |  |  |  |  |  |  |
| 11 | Participate in NaneNane agricultural shows |  |  |  |  |  |  |  |  |  |  |  |  |
| 12 | Harvesting of trials |  |  |  |  |  |  |  |  |  |  |  |  |
| 13 | Data processing and analysis |  |  |  |  |  |  |  |  |  |  |  |  |
| 14 | Meeting with project team members |  |  |  |  |  |  |  |  |  |  |  |  |
| 15 | Dataverse uploading |  |  |  |  |  |  |  |  |  |  |  |  |
| 16 | Preparation of final technical report |  |  |  |  |  |  |  |  |  |  |  |  |

## Outcome 3: Food and feed safety, nutritional quality, and income security of target smallholder families improved equitably (within households)

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| a. Output 3.1 | | | Demand-driven research products to reduce postharvest losses and improve food quality and safety piloted in target areas [and scaled in Outcome 5] | | | | | | | | |
| b. Activity 3.1.1 | | | Conduct packaging and delivery of postharvest technologies through community and development partnerships with iterative review, refining, and follow-up | | | | | | | | |
| c. Sub-activity 3.1.1.1 | | | Assess the impact of nutritional messaging on farmers nutritional knowledge, attitude and practices and household nutrition status, in partnership with Islands of Peace | | | | | | | | |
|  | | | | | | | | | | | |
| d. Research team | | | | | | | | | | | |
| *Name* | | | | *Institution* | | *Role* | | | | | |
| Justus Ochieng | | | | WorldVeg | | PI | | | | | |
| Ludovic Joly | | | | Iles de Paix (IDP) | | Fund and participate in nutrition training | | | | | |
| Christopher Mutungi | | | | IITA | | Participate in post-harvest training for improved nutritional outcomes and participate in data analysis. | | | | | |
| IFPRI | | | | IFPRI | | M&E Support | | | | | |
|  | | | | | | | | | | | |
| e. Students: Nil | | | | | | | | | | | |
|  | | | | | | | | | | | |
| f. Locations: | 16 Villages in Karatu: 8 are listed while additional 8 villages will be identified by IDP. Kambi ya samba, Bashay, Buger, Gyekrumlambo, Slahhamo, Rhotia Kainam, Chem, Changarawe | | | | | | | | | | |
|  | | | | | | | | | | | |
| g. Start date | | January 2019 | | | | | | | | | |
|  | | | | | | | | | | | |
| h. End date | | 30 September 2020 | | | | | | | | | |
|  | | | | | | | | | | | |
| 1. Justification | | | | | | | | | | | |
| Smallholder farmers are also consuming of the harvest they produce. Hence, improved knowledge on the nutritional significance of a high diversity of foods will have an immediate impact on their livelihoods. In this context, Ochieng *et al*. (2018[[21]](#footnote-21)) found that households benefiting from traditional African vegetables (TAV) promotion and demand creation activities had a significantly higher dietary diversity for children under five and women of reproductive age. The integration of dietary diversification with better postharvest management of common staples has the potential for stepping–up the improvements of household nutritional outcomes. Therefore, this intervention will not only introduce various vegetable-based recipes but also encourage the households to eat a more nutritious and diverse diet for healthy living through training while also ensuring better postharvest management of harvested produce. It also aims at influencing key vegetable value chain actors such as government through the Ministry of Agriculture (MoA), and Ministry of Health and Social Welfare (MOH&SW), and NGOs (RECODA, IDP, MVIWATA). Farm households and food kiosks will be trained on general nutrition guidelines and preparation of nutritious recipes and the impact of nutritional of the training evaluated.  A baseline survey on 489 households was done in Karatu during 2018/2019 period to assess the impact of nutritional education on farmers nutritional knowledge, attitude and practices (KAP), income and household nutrition. The baseline was done in 16 intervention villages. The baseline results show that 30% of households from the intervention villages are not aware of the nutritional value of vegetables and 80% believe that all vegetables contain the same nutrients important for human health and growth. Besides, more than 80% does not know the amount of vegetables and fruits to consume daily. Finally, households consume a less diversified diet. Dietary diversity is still low with households consuming on average 6 different food groups with the majority consuming cereal-based foods and few protein-rich foods (such as eggs, meat and fish). Therefore, it is important to train households in the importance of a diversified diet. The first nutrition training was conducted in 2018/2019 in 8 villages. In 2019/2020 the training will be conducted in the 8 remaining villages to cover all the 16 villages where the baseline was conducted. | | | | | | | | | | | |
|  | | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | | |
| 2.1 To increase consumption of diverse nutrient-rich foods by poor rural and peri-urban households in Tanzania | | | | | | | | | | | |
| 2.2 To estimate the impact of nutritional education on farmers nutritional knowledge, attitude and practices (KAP), income and household nutrition. | | | | | | | | | | | |
| 2.3 To test uptake of nutritious recipes using model food kiosks/village restaurants | | | | | | | | | | | |
|  | | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | | |
| 3.1 What is the impact of farmer education in nutrition on their knowledge, attitude and practices? | | | | | | | | | | | |
|  | | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | | |
| Experiment design, implementation and data analysis:  The nutritional messages developed by Worldveg’s Nutrition-Sensitive Promotion of Vegetables (NutriSenseProm) project in Kakamega Kenya will be adapted to the local situation before training the households and food kiosks in Karatu. The intervention will be done in 16 villages. During 2018/2019 8 villages participated in the training and 332 (160 males and 172 females) households were trained from first 8 villages. For the intervention areas/villages, the project employs two randomly assigned treatments: (1) Without any nutritional message (control)-10 groups, (2) Nutrition message 1 (M1) and nutrition message (M2)-16 groups. Intervention groups will be provided with seed kits to facilitate vegetable production and trained together with WorldVeg and IDP. For ethical reasons, the control group will be provided with seed kits so that the participants receive some input and consequently receive a kind of treatment at the end of the intervention (in 2021). Two sets of messages will be tested. Also, in 8 villages, 16 food kiosks (2 from each village) were trained on how to prepare different vegetable-based recipes for inclusion in their food menus. Acceptability of the recipes will be evaluated. In 2019/2020, an additional 16 food kiosks (*Mgahawa in Kiswahili*) will be trained. | | | | | | | | | | | |
|  | | | | | | | | | | | |
| 5. Data (with indicators and metrics) to be collected and uploaded on Dataverse | | | | | | | | | | | |
| Domain & Indicator | Field/plot level metrics | | | | Farm level metrics | | Household level metrics | | Community/ landscape metrics | Measurement method | |
| Productivity | | | | | | | | | | | |
| *Vegetable productivity* |  | | | | Kg/ha/season | | Kg/ha/season | | - | Survey | |
| *Post-harvest loss* |  | | | |  | | % harvest lost | |  | Survey | |
| Economic | | | | | | | | | | | |
| *Income diversification index* |  | | | | Diversification index (Simpson/ Herfindahl index) | | Diversification index (Simpson/ Herfindahl index) | |  | Survey | |
|  | | | | Number of income sources | | Number of income sources | |  | Survey | |
| *Market participation* | - | | | | - | | % production sold | | total sales | Survey | |
| Human Condition | | | | | | | | | | | |
| *Nutrition* | - | | | | Availability of diverse vegetable crops (numbers) | | Access to nutritious foods  Dietary diversity (24hr recall) | | Dietary diversity (24hr recall) | Survey | |
| *Food Security* | - | | | | - | | Months of food insecurity | |  | Focus group discussions (FGD) | |
| Social | | | | | | | | | | | |
| *Gender equity* |  | | | | Land access by gender  Market participation by gender  Rating of technologies by gender | | Land access by gender  Market participation by gender  Rating of technologies by gender | |  | Focus group discussions (FGD) | |
| *Collective action* |  | | | |  | | Participation in a collective action group (% of households in groups) | | Number of collective action groups | Key informant interviews (KII) & FGD | |
|  | | | | | | | | | | | |
| 6. Deliverables: | | | | | | | | Means of verification | | | Delivery date |
| 6.1 Sensitization meetings in the new villages | | | | | | | | Sensitization meeting reports | | | Nov. 2019 |
| 6.2 Baseline survey report (covering SI domains) | | | | | | | | Baseline report | | | Mar. 2020 |
| 6.3 At least 350 households trained on nutrition | | | | | | | | Nutrition training report | | | Sep. 2020 |
| 6.4 At least two new vegetable-based recipes developed and promoted (excluding those previously developed by WorldVeg) | | | | | | | | Recipe report | | | Jul. 2020 |
| 6.5 At least four food kiosks/restaurants include recipes in their food menu | | | | | | | | Recipe report | | | Jul. 2020 |
| 6.6 At least 1 success/blog story | | | | | | | | Success story online | | | Sep. 2020 |
| 6.7 Partners include nutrition education in their existing /new programs | | | | | | | | Technical report | | | Sep. 2020 |
|  | | | | | | | | | | | |
| 7. How will scaling be achieved? | | | | | | | | | | | |
| RECODA and MVIWATA will include nutrition education in their programs in other regions (e.g. in Babati). | | | | | | | | | | | |
|  | | | | | | | | | | | |
| 8. How are activities in this protocol linked to those of others? | | | | | | | | | | | |
| Improved vegetable varieties and good agronomic practices for new traditional African vegetables (TAV) are being scaled by IDP in new villages (sub-activity 5.2.2.1) and IITA post-harvest management activities. | | | | | | | | | | | |

9. Gantt chart

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Main Activity | Description/Sub-Activity | 2019 | | | 2020 | | | | | | | | |
| Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep |
| Introduction and promotion of improved varieties and good agricultural practices (GAP) in new and old villages (Lead-WorldVeg) | Nursery establishment and nursery management practices |  |  |  |  |  |  |  |  |  |  |  |  |
| Establish research trials plot and transplant seedlings (practices) |  |  |  |  |  |  |  |  |  |  |  |  |
| Distribution of seed kits (distribution of seed kits to trainees) |  |  |  |  |  |  |  |  |  |  |  |  |
| Good agricultural practices (GAP) and IPM practices |  |  |  |  |  |  |  |  |  |  |  |  |
| Proper harvesting and post-harvest principles and technologies |  |  |  |  |  |  |  |  |  |  |  |  |
| Data collection/seasonal transects/FGD |  |  |  |  |  |  |  |  |  |  |  |  |
| Community empowerment (Lead: WorldVeg) | 1 Field day |  |  |  |  |  |  |  |  |  |  |  |  |
| Backstopping IDP to scale improved management practice in new villages (Lead: IDP) | Participate in awareness creation (vegetable farming as a business (value chain thinking) |  |  |  |  |  |  |  |  |  |  |  |  |
| Train IDP staff how to effectively scale out the improved technologies |  |  |  |  |  |  |  |  |  |  |  |  |
| Nutrition training in new villages (Lead: WorldVeg) | Nutrition message training |  |  |  |  |  |  |  |  |  |  |  |  |
| Train food kiosks on recipe preparation and evaluate recipe acceptability |  |  |  |  |  |  |  |  |  |  |  |  |
| Focus groups discussions and Key informant interviews (KII) to assess collective action activities |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Survey/FGD to assess/monitor the uptake of nutritious recipes |  |  |  |  |  |  |  |  |  |  |  |  |
| Monitoring & Evaluation (Lead: WorldVeg) | Regular M&E visits to support partner IDP |  |  |  |  |  |  |  |  |  |  |  |  |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Outcome 3: Food and feed safety, nutritional quality, and income security of target smallholder families improved equitably (within households) | | | | | | | | | | |
| a. Output 3.1 | | | Demand-driven research products to reduce postharvest losses and improve food quality and safety piloted in target areas [and scaled in Outcome 5] | | | | | | | |
| b. Activity 3.1.1 | | | Conduct packaging and delivery of postharvest technologies through community and development partnerships with iterative review, refining, and follow-up | | | | | | | |
| c. Sub-activity 3.1.1.2: | | | Evaluate influence of farmer storage structures and environment on physical and economic losses abatement by hermetic storage devices | | | | | | | |
|  | | | | | | | | | | |
| d. Systems research team | | | | | | | | | | |
| Name | | | Institution | | | Role | | | | |
| Christopher Mutungi/ Adebayo Abass | | | IITA | | | Principal investigators | | | | |
| Job Kihara | | | CIAT | | | Investigate benefits of maize/ legume cropping systems in Babati; IITA’s data will contribute to the human domain. | | | | |
| Julius Manda | | | IITA | | | Contribute to the development of survey tool and analysis of socio-economic data | | | | |
| Gundula Fischer | | | IITA | | | Advise analysis of gender aspects | | | | |
| Anicet Sambala | | | IITA | | | M & E support | | | | |
|  | | | | | | | | | | |
| e. Student(s) Nil | | | | | | | | | | |
|  | | | |  | | | | | | |
| f. Location(s) | | | | Babati/ Karatu / Kongwa/ Kiteto Districts | | | | | | |
|  | | | |  | | | | | | |
| g. Start | | | | 2018 | | | | | | |
| h. End | | | | 2020 | | | | | | |
|  | | | | | | | | | | |
| 1. Justification | | | | | | | | | | |
| Postharvest loss reduces the food available for consumption and, therefore, has direct impacts on food security, nutrition, and household welfare. Improved technologies for postharvest losses reduction, can help farmers to be more efficient, access better markets, or decrease the number of food deficit days enabling them to switch time and income expenditures to diversify diets or invest in household welfare items depending on context/ typology. Since Africa RISING inception, improved post-harvest technologies and practices have been exposed to many communities in Tanzania and one often hears many stories from farmers on how they have improved nutrition, resilience and quality of life. There is a need for a systematic study to measure these benefits within the frame of sustainable intensification and confirm the acceptability of the technologies. In 2018/19, the technical superiority of different air-tight technologies for the storage of maize and beans in contrasting agro-locations was confirmed. There were outright differences in outcomes, which seemed to interest farmers to like some technologies more than others. Technologies will only be attractive to the extent of compelling farmers to invest in them if the perceived benefits substantially offset the costs (directly or indirectly) as opposed to technical superiority alone. Some benefits may be measured in monetary terms, while others may not be measurable as such. This study will generate data to fill this gap by confirming farmer acceptability of the technologies and potential impacts. | | | | | | | | | | |
|  | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | |
| 2.1 To study the gender aspects of different types of air-tight technologies for storage of cereals (maize) and legumes (beans) | | | | | | | | | | |
| 2.2 To assess the impacts of improved postharvest technologies on nutrition, food security and welfare of farmers in Tanzania. | | | | | | | | | | |
|  | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | |
| 3.1 How do men and women farmers perceive and rate the benefits of different air-tight technologies for cereal and legume grain storage? | | | | | | | | | | |
| 3.2 What are the impacts of using improved postharvest technologies and practices on the nutritional, food security, and welfare of households in Tanzania? | | | | | | | | | | |
| 3.3 Are there potential differences in the achievement of nutrition, food security, and welfare benefits between men, women, and members of different age groups in the household? | | | | | | | | | | |
|  | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | |
| Experiment design, implementation and data analysis:  This study will be conducted in two parts: The first part will apply focus group discussion, participatory exercises and key informant interviews to study gender dynamics around the acceptability of different types of air-tight storage technologies by farmers. The gender study will align with the SI indicator framework so that gendered perceptions are captured on all SI domains (Fischer *et al*., 2018[[22]](#footnote-22)). In this part of the study, only farmers who have had experience with the technologies (used the technologies) for at least one postharvest cycle will take part. Data will be transcribed and analyzed using qualitative methods. In the second part, a detailed socio-economic survey will be conducted using structured questionnaires to collect detailed data on demographics, food and non-food expenditure, food security, shocks, and safety nets, among others, from user and non-user households of postharvest technologies. Descriptive statistics and empirical modelling approaches, such as endogenous switching regression analysis will be used in the data analysis. | | | | | | | | | | |
|  | | | | | | | | | | |
| 5. Data (with indicators and metrics) to be collected and uploaded on Dataverse | | | | | | | | | | |
| Domain & *Indicator* | Field/plot level metrics | Farm level metrics | | | Household level metrics | | | Community /landscape metrics | | Measurement method |
| Human | | | | | | | | | | |
| *Nutrition* |  |  | | | * Household dietary diversity score (HDDS) * Minimum Woman’s * Dietary Diversity Score (MDD-W); * Nutritional status (stunting, underweight, wasting) | | |  | | Survey |
| *Food security* |  |  | | | * Months of food insecurity * Rating of food security | | |  | | Survey |
| Social | | | | | | | | | | |
| *Gender equity* |  |  | | | * Nutrition by gender * Food security by gender * Rating of technologies by gender | | |  | | Survey, Focus group discussions & participatory exercises |
|  | | | | | | | | | | |
| 6. Deliverables | | | | | | | Means of verification | | Delivery date | |
| 6.1 One household survey completed; nutritional, food security, and household welfare impacts of improved postharvest technologies established | | | | | | | Report, draft manuscript for publication | | Sep. 2020 | |
| 6.2 One gender study completed, perception and technology rating by gender established | | | | | | | Report | | Sep. 2020 | |
| 6.3 Collected research data | | | | | | | Data uploaded on Dataverse | | Sep. 2020 | |
|  | | | | | | | | | | |
| 7. How will scaling be achieved? | | | | | | | | | | |
| Partnership with IDP to scale out improved postharvest management technologies and practices to 1,800 new beneficiaries. Furtherance of scaling to be supported through short message service (SMS) on MWANGA Platform. | | | | | | | | | | |
|  | | | | | | | | | | |
| 8. How are the activities in this protocol linked to those of others? | | | | | | | | | | |
| This activity is linked to Integrated Soil Fertility Management System activities (1.1.1.6, 1.1.1.7, and 2.2.1.3) that are integrating maize and legume production in Babati and Kongwa, Kiteto. Findings will particularly provide data for human condition domain, nutrition and food security. | | | | | | | | | | |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Outcome 3: Food and feed safety, nutritional quality, and income security of target smallholder families improved equitably (within households) | | | | | | | | | | | | | | |
| a. Output 3.2 | | | Nutritional quality due to increased accessibility and use of nutrient-dense crops by farmers improved | | | | | | | | | | | |
| b. Activity 3.2.1 | | | Promote and deploy nutrient-rich crop varieties and livestock feed resources in target communities | | | | | | | | | | | |
| c. Sub-activity 3.2.1.1 | | | Elucidate pathways to sustainable adoption of nutrient diets and aflatoxin mitigation practices in rural communities of Central Tanzania | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| d. Research team | | | | | | | | | | | | | | |
| Name | | | Institution | | | | Role | | | | | | | |
| Patrick Okori | | | ICRISAT (PI) | | | | Oversee implementation, quality assurance and reporting. | | | | | | | |
| Wanjiku Gichohi | | | ICRISAT (Co-PI) | | | | Conceptualize and design studies to answer research question  Coordinate assembly of data from both research and monitoring activities  Student supervision  Engage with other Africa RISING local and CGIAR partners | | | | | | | |
| Theresia Jumbe | | | SUA (Co-PI) | | | | Data analyses, Publication preparation and Student supervision | | | | | | | |
| John Msuya | | | SUA (Co-PI) | | | | Data analyses, Publication preparation and Student supervision | | | | | | | |
| IFPRI | | | IFPRI/IITA (ESA M&E) | | | | Provide support in monitoring of the research activities to ensure compliance to FtF monitoring system and uploading of data into the FtF data management system | | | | | | | |
|  | | | | | | | | | | | | | | |
| e. Student(s): | | | | | | | | | | | | | | |
| Name | | Institute | | | Degree | | | | | Start | | | | End |
| Ruth Mremi | | SUA | | | MSc. Human Nutrition | | | | | July 2018 | | | | July 2020 |
| Monica Chande | | SUA | | | MSc. Human Nutrition | | | | | July 2018 | | | | July 2020 |
|  | | | | | | | | | | | | | | |
| f. Locations | | | Kongwa, Kiteto | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| g. Start date | | | November 2018 | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| h. End date | | | August 2020 | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 1. Justification | | | | | | | | | | | | | | |
| Understanding drivers of food choice in diverse and dynamic settings is particularly critical to inform the design of production-to-consumption interventions for society (Bailey *et al.*, 2018[[23]](#footnote-23)). Since 2014 we developed nutritious diets and trained mothers on the use of such diets to feed their children. To improve adoption of food-based interventions, a deeper understanding of underlying drivers of dietary choices at households is critical. This study aimed to gain a deeper understanding of the factors that influence the choice of food consumption by nutrition-beneficiary households in Kongwa and Kiteto districts in the context of the transition from their pre-dominant maize-based diets. Indeed, during our engagement with some of the nutrition-beneficiaries, we noted varied use of the diets.  In the 2018-2019 project year, we conducted cross-sectional studies involving the nutrition beneficiaries to investigate drivers of food choice. The data assembled includes (i) Household socio-economic contexts of nutrition-beneficiary households, (ii) Qualitative and quantitative data on standard and agreed variables (generated through FGDs with key informants locally). All nutrition-beneficiary households are women and children (engaged in our under 5-year-old nutrition-centred interventions). (iii) A panel of 300 mothers (100 per village) from Moleti, Mlali and Laikala has been assembled and pre-trained for the study for the nutrient-dense local diet dis-adoption study.  Preliminary results show that more than 60% of caregivers are unaware of the nutrient content of pearl millet, though they are aware of the benefits of iron and zinc (which are present in pearl millet) to the health of their children. The results further show that doctors are respected as key care and knowledge that influences people to consume specific foods. These results and others yet being processed, will be used to inform the design of the dis-adoption study to be conducted the 300 mothers. For the dis-adoption study key drivers of food choice identified through the cross-sectional study will be used to engage the dis-adoption study cohort to drill-down on the contextualized drivers of dis-adoption. These will also benefit from data available in Dataverse especially demographics. Completion of the dis-adoption study may, however, require additional funds. | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | | | | | |
| 2.1 To develop a context- and culture-specific framework to understand the behavioural drivers of food choice relating to pigeon pea in Kongwa and Kiteto districts | | | | | | | | | | | | | | |
| 2.2 To investigate the behavioural drivers of food choice relating to pearl millet in Kongwa | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | | | | | |
| 3.1 What are the drivers of food choice for pigeon pea and other legume-based foods in rural households of Kongwa & Kiteto districts of central Tanzania? | | | | | | | | | | | | | | |
| 3.2 What are the drivers of food choice for pearl millet and other dryland cereal and or maize-based foods in rural households of Kongwa districts of central Tanzania? | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | | | | | |
| Experiment design, implementation and data analysis:  Cross-sectional studies were conducted to collect detailed information on the frequency of consumption of pearl millet and pigeon pea. Focused group discussions were conducted involving key informants to identity “model” construct areas of the questionnaire for investigating determinants of food choice and consumption behaviour in the focus districts. Some of the model areas include: knowledge, perceived susceptibility, perceived severity, health value, healthy behaviour identity, attitudes towards behaviour, perceived barriers among others. (More details can be found in the protocol). Key informants were stratified into four groups (i) mothers or female caretakers, (ii) fathers or male caretakers, (iii) grandmothers, (iv) community health workers and lead farmers. The guide questions in the FGD were subsequently used to gather information on factors influencing food choice and consumption behaviour. Completion of the analysis is planned for quarter 1 and 2 of 2020. | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 5. Data to be collected and uploaded on Dataverse | | | | | | | | | | | | | | |
| Domain & *Indicator* | | | | Household level metrics | | | | | | | Measurement method | | | |
| Human | | | |  | | | | | | |  | | | |
| *Food security* | | | | Food accessibility | | | | | | | Survey | | | |
| *Nutrition* | | | | Food consumption score | | | | | | | Survey | | | |
|  | | | | | | | | | | | | | | |
| 6. Deliverables | | | | | | | | Means of verification | | | | Delivery date | | |
| 6.1 Drivers of food choice in Semi-Arid central Tanzania established | | | | | | | | Project progress report | | | | Jun. 2020 | | |
| 6.2 publications on drivers of food choice | | | | | | | | Publications/student thesis | | | | Aug. 2020 | | |
| 6.3 Guidelines for scaling out improved nutrition based on local food contexts developed | | | | | | | | Project popular publication | | | | Aug. 2020 | | |
|  | | | | | | | | | | | | | | |
| 7. How will scaling be achieved? | | | | | | | | | | | | | | |
| The project will generate guild-lines for scaling out improved nutrition based on local food contexts. This will be shared with non-governmental organizations interested and implementing nutrition sensitive and specific activities. As a first step partnership will be established with WFP that is already working in Kongwa and Kiteto. | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 8. How are the activities in this protocol linked to those in others? | | | | | | | | | | | | | | |
| Multi-team participation will be adapted during the implementation process to explore the synergies between the crop production and nutrition teams in influencing food choice and utilization. The data generated will inform especially the human indicators of other project activities sub-activity 3.2.1.1 (b) and will be available to the systems scientist on Gender and M&E. | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 9. Gantt chart | | | | | | | | | | | | | | |
| No. | Activity | | | | | Start date | | | End date- | | | | Total workdays- | |
| 1. | Conceptualize and design studies | | | | | Fri 11/01/19 | | | Mon 12/30/19 | | | | 42 | |
| 2. | Data collection, analyses and reporting | | | | | Mon 6/01/20 | | | Fri 8/28/20 | | | | 65 | |

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| Outcome 3: Food and feed safety, nutritional quality, and income security of target smallholder families improved equitably (within households) | | | | | | | | | | | | | |
| a. Output 3.2 | | | | Nutritional quality due to increased accessibility and use of nutrient-dense crops by farmers improved | | | | | | | | | |
| b. Activity 3.2.1 | | | | Promote and deploy nutrient-rich crop varieties and livestock feed resources in target communities | | | | | | | | | |
| c. Sub-activity 3.2.1.2 | | | | Promote farmer production of nutrient-dense (Zn, Fe) SER83 and NUA45 bean varieties | | | | | | | | | |
|  | | | | | | | | | | | | | |
| d. Systems research team | | | | | | | | | | | | | |
| Name | | | | | Institution | | | | Role | | | | |
| Rowland Chirwa | | | | | CIAT | | | | PI, bean integration | | | | |
| Agnes Mwangwela | | | | | LUANAR | | | | Nutrition outcome tracking, food quality/safety | | | | |
| Julius Manda | | | | | IITA | | | | Economics analysis support | | | | |
|  | | | | | DADO offices | | | | Backstop R4D activities | | | | |
|  | | | | | | | | | | | | | |
| e. Students | | | | | | | | | | | | | |
| Name | | | Institute | | | | Degree | | | | Start | | End |
| Melise Mwachumu | | | LUANAR | | | | MSc Food Science and Technology | | | | 2019 | | 2021 |
| Kondwani Luwe | | | LUANAR | | | | MSc Human Nutrition | | | | 2018 | | 2020 |
|  | | | | | | | | | | | | | |
| f. Locations | | Linthipe EPA | | | | | | | | | | | |
|  | | | | | | | | | | | | | |
| g. Start date | | January 2017 | | | | | | | | | | | |
|  | | | | | | | | | | | | | |
| h. End date | | September 2021 | | | | | | | | | | | |
|  | | | | | | | | | | | | | |
| 1. Justification | | | | | | | | | | | | | |
| Maize occupies a disproportionately 70-80% of cropped land in central Malawi, leaving only at most 30% of the land for grain legumes and other minor crops. Dietary diversity studies have confirmed the dominant role of maize in diets. Consequently, protein and micronutrient deficiencies are widespread. Over the years, we have advocated for a shift towards intensified scaling of grain legumes on farms. While this is one pathway towards bringing more balance on farms and improved nitrogen cycling through biological N2-fixation, there is an opportunity to improve nutrition without necessarily changing the proportion of land allocated to grain legumes. This could be achieved through increased use of nutrient-dense crop varieties. Early maturing biofortified (NUA45) and drought tolerant (SER83) common varieties were introduced in Linthipe and Dedza in 2018/19 under different cropping systems. Through an innovative community seed multiplication initiative, more than 20% of 2,000 households in Mposa section in Linthipe now have access to nutrient-dense common bean varieties.  There is need to collect more data over years (at least 3-years) to have conclusive results on the performance of the NUA45 and SER83 compared to local varieties in different cropping systems, and under different agro-ecologies (altitude and soil types). Over the past year, we successfully produced seed that will be distributed to 500 farmers during the 2019/20 cropping season. To establish the benefits from these two varieties, studies on social acceptability, market participation and nutritional benefits assessment will be done during 2020. | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | | | | |
| 2.1 Identify bean varieties, bush or climbing that fit best in the maize-based cropping systems to supply better quantities of combined maize and bean grain for human food (calorie), nutrition (protein) and income security | | | | | | | | | | | | | |
| 2.2 Establish the link between access to and use of nutrient-dense common bean varieties and improved human nutrition outcomes | | | | | | | | | | | | | |
| 2.3 Establish the social acceptability of improved common bean varieties (taste, cooking time, etc.) versus traditional varieties | | | | | | | | | | | | | |
| 2.4 Document the nutritional quality and bioactive properties of bio-fortified beans | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | | | | |
| 3.1 What bean varieties fit best in the maize-based cropping systems to supply better quantities of combined maize and bean grain for human food (calie), nutrition (protein) and income security? | | | | | | | | | | | | | |
| 3.2 What is the link between access to and use of nutrient-dense common bean varieties and improved human nutrition outcomes? | | | | | | | | | | | | | |
| 3.3 How can the social acceptability of nutrient-dense common bean varieties (tase, cooking time, etc.) versus traditional beans be improved? | | | | | | | | | | | | | |
| 3.4 What are the nutritional qualities and bio-active properties of bio-fortified beans? | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | | | | |
| Experiment design, implementation and data analysis:  This experiment will test the combination of maize with two types of common bean growth habits (bush and climbing). Within each bean growth habit, there will be two types of varieties which have been selected on purpose. Among the bush bean category, both varieties are already released in Malawi, where SER83 is known for drought tolerance, and NUA45 is known for nutrition-biofortified (high Fe and Zn content). In the climbing bean category, there is a local variety (Domwe wawilira) and a new test variety (MAC109). To compare maize with maize/bean intercrop treatments, one plot will be planted to maize pure stand. Likewise, to compare bean/maize intercrop with bean only, the whole set of bean varieties will be planted in a pure stand, where the climbing bean will be supported by stakes. This sub-activity is closed linked to sub-activity 3.2.2.3 (Determining quality and safety of locally produced legume grain-derived complementary foods and adoption in Dedza District. The objectives 2-4 will be studied in sub-activity 3.2.2.3; here we will produce the material required for that legume utilization and effects study. | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | |
| 5. Data (with metrics) to be collected and uploaded on Dataverse | | | | | | | | | | | | | |
| SI Domains & *Indicator* | Field/Plot level metrics | | | | | Farm level metrics | | Household level metrics | | Community /landscape metrics | | Measurement method | |
| Productivity | | | | | | | | | | | | | |
| *Bean grain productivity* | Bean grain productivity (kg/ha/season) | | | | |  | |  | |  | | Field measurements | |
| *Bean biomass productivity* | Bean biomass productivity (kg/ha/season) | | | | |  | |  | |  | | Field measurements | |
| Economic | | | | | | | | | | | | | |
| *Profitability* | Gross margin in $/ha/season, Benefit-Cost Ratio | | | | |  | |  | |  | | Survey | |
| *Income diversification* |  | | | | |  | | Number of income sources | |  | | Survey | |
| Environmental | | | | | | | | | | | | | |
| *Soil chemical quality* | Biological N2-fixation (kg N/ha/season) | | | | |  | |  | |  | | Field measurements | |
| *Water availability* | Soil moisture | | | | |  | |  | |  | | Survey | |
| Human Condition | | | | | | | | | | | | | |
| *Nutrition* | Protein production (g/ha) | | | | | Total protein production (g/ha); | |  | | Market/landscape supply of diverse food | | Surveys, lookup tables | |
|  | Micronutrient production (g/ha) | | | | | Total micronutrient production (g/ha) | |  | | Dietary diversity | | Survey | |
| *Food Security* |  | | | | |  | | Food utilization, months of food insecurity | |  | | Surveys and lookup tables | |
| Social | | | | | | | | | | | | | |
| *Gender equity* |  | | | | |  | | Rating of technologies by gender | | Market participation by gender | | Participatory evaluation | |
| *Equity (generally)* |  | | | | |  | | Rating of technologies by group | |  | | Participatory evaluation | |
|  | | | | | | | | | | | | | |
| 6. Deliverables | | | | | | | | Means of verification | | | | Delivery date | |
| 6.1 Nutrient-dense common bean seed distributed to about 500 farmers | | | | | | | | List of farmers involved by site, disaggregated by sex | | | | Jan. 2020 | |
| 6.2 At least 3 mother trials and 20 baby trials per mother established | | | | | | | | Field trials established | | | | Jan. 2020 | |
| 6.3 Yield distribution/range for common bean production using improved germplasm | | | | | | | | Yield distribution analyzed, box plots plotted and available in technical reports | | | | Jun. 2020 | |
| 6.4 Micronutrient content from produce from farmer fields documented | | | | | | | | Report documenting micronutrient content on samples from at least 100 farms | | | | Aug. 2020 | |
| 6.5 At least 3 feedback meetings held with farmers between March and August 2019 | | | | | | | | Reports on meetings with farmers | | | | Sep. 2020 | |
| 6.6 Estimates of productivity and yield gaps for local and improved bean varieties | | | | | | | | Scientific draft publication | | | | Sep. 2020 | |
|  | | | | | | | | | | | | | |
| 7. How will scaling be achieved? | | | | | | | | | | | | | |
| CIAT uses the Southern Africa Bean Network for scaling through working with the Malawi Government Extension System to reach 5,000 farmers in bean growing areas, and in other SADC countries.  Scaling is limited to agro-ecologies that are suitable for common bean production. There will be farmer and extension exchange visits between Linthipe and Bekeke EPA farmers. | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | |
| 8. How are the activities in this protocol linked to those of others? | | | | | | | | | | | | | |
| The LUANAR Nutrition Department will study the nutrition outcomes among households utilizing nutrient-dense common bean varieties produced from this protocol. | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | |
| 9. Gantt chart | | | | | | | | | | | | | |
| see sub-activity 1.1.1.2 | | | | | | | | | | | | | |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Outcome 3: Food and feed safety, nutritional quality, and income security of target smallholder families improved equitably (within households) | | | | | | | | | | | | |
| a. Output 3.2 | | Nutritional quality due to increased accessibility and use of nutrient-dense crops by farmers improved | | | | | | | | | | |
| b. Activity 3.2.1 | | Promote and deploy nutrient-rich crop varieties and livestock feed resources in target communities | | | | | | | | | | |
| c. Sub-activity 3.2.1.3 | | Determining the quality and safety of locally produced legume grain-derived complementary foods and adoption in Dedza District | | | | | | | | | | |
|  | | | | | | | | | | | | |
| d. Research team | | | | | | | | | | | | |
| Name | | | | Institution | | | | Role | | | | |
| Agnes Mwangwela | | | | LUANAR | | | | PI, Nutrition outcome tracking studies/food quality/safety | | | | |
| Rowland Chirwa | | | | CIAT | | | | Nutrient-dense common bean production research component | | | | |
| e. Students | | | | | | | | | | | | |
| Name | | Institute | | | Degree | | | | | Start | | End |
| Kondwani Luwe | | LUANAR | | | MSC Human Nutrition | | | | | 2018 | | 2020 |
| Melise Mwachumu | | LUANAR | | | MSc Food Science & Technology | | | | | 2019 | | 2021 |
| Sunganani Chowa | | LUANAR | | | MSc Human Nutrition | | | | | 2018 | | 2020 |
|  | | | | | | | | | | | | |
| f. Locations | | | | Linthipe EPA | | | | | | | | |
|  | | | | | | | | | | | | |
| g. Start date | | | | January 2017 | | | | | | | | |
|  | | | | | | | | | | | | |
| h. End date | | | | September 2021 | | | | | | | | |
|  | | | | | | | | | | | | |
| 1. Justification | | | | | | | | | | | | |
| Malnutrition is a major cause of premature deaths, especially among young children. Availability of foods with a high concentration of protein and micronutrients is vital for communities that have diets dominated by maize products. For the past 1 year, over 500 farmers in Linthipe EPA have been involved in food and nutrition training, where dietary diversity and consumption patterns have been studied. Farmers that were organized in nutrition groups have been trained in nutrition education, WASH, and cooking demonstration of different dishes for the whole household including complementary foods. Participants were drawn from households participating in Africa RISING sustainable intensification activities, where maize/legume rotations and grain legume utilization have been promoted for more than 5 years. CIAT has introduced new nutrient-dense common bean varieties that have been produced by farmers. Grain legumes, especially nutrient-dense common bean varieties, provide an important opportunity for improved nutrition outcomes among farming households if the produce is not wholly marketed. The nutrition training has increased access to important information for more local use of the products. We estimate that 40% of the households that directly worked with CIAT and LUANAR nutrition department over the years are now incorporating nutrient-dense common bean varieties as part of their diets.  The proposed study focuses on complementary foods, utilizing readily available ingredients to demonstrate how these foods would protect children from undernutrition. We will track the human nutrition benefits of increased utilization of nutrient-rich foods locally produced by farmers. | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 2. Objective | | | | | | | | | | | | |
| 2.1 The study will examine the efficacy of three complementary foods for improving the nutritional status of children. | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | | | |
| 3.1 How do improved quality and safety of locally produced legume grain-derived complementary foods promote adoption in Dedza District? | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | | | |
| Experiment design, implementation and data analysis:  The main study is designed as a randomized controlled feeding trial in Dedza. Ninety children aged 8 to 12 months old will be randomly allocated to three supplementary food interventions: maize-soybean flour blend (the current recommended complementary food), maize-goat powder blend, and maize-bean flour blend. The groups have been trained in nutrition education, WASH, and cooking demonstration of different dishes for the whole household including complementary foods. The proposed study is aimed at focusing attention on the complementary foods utilizing readily available ingredients to demonstrate how these foods would protect children from undernutrition. | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 5. Data (with metrics) to be collected and uploaded on Dataverse | | | | | | | | | | | | |
| SI Domains & Indicator | Field/Plot level metrics | | Farm level metrics | | | Household level metrics | | | Community /landscape metrics | | Measurement method | |
| Human condition | | | | | | | | | | | | |
| *Nutrition* | Protein production (g/ha) | | Protein production (g/ha) | | | Availability of diverse food crops, Dietary diversity | | | Availability of diverse food crops | | Surveys,  Laboratory testing | |
|  | Micronutrient production (g/ha) | | Micronutrient production (g/ha) | | |  | | |  | | Lookup tables | |
| *Food Security* |  | |  | | | Food availability, Food utilization, composite index | | |  | | Surveys | |
| *Food Safety* |  | |  | | | Mycotoxins (micrograms/kg) | | |  | | Laboratory testing | |
| Social | | | | | | | | | | | | |
| *Gender Equity* |  | |  | | | Nutrition/Food security by gender | | | Women Empowerment in Agriculture Index | | Individual survey, household survey | |
| *Social Cohesion* |  | |  | | | Level and reliability of social support | | | Participation in social groups | | Household survey | |
|  | | | | | | | | | | | | |
| 6. Deliverables | | | | | | | Means of verification | | | | Delivery date | |
| At least 2 field days held with nutrition groups, especially HIV/AIDS action groups in Linthipe, jointly with DNCC | | | | | | | Field day reports | | | | Jul. 2020 | |
| Three recipes available | | | | | | | Recipe booklet | | | | Aug. 2020 | |
| Improved child nutrition status demonstrated | | | | | | | Report: Anthropometry and infant and young child feeding | | | | Sep. 2020 | |
| FtF target of 5,000 HH beneficiaries met | | | | | | | FtF database | | | | Sep. 2020 | |
|  | | | | | | | | | | | | |
| 7. How will scaling be achieved? | | | | | | | | | | | | |
| The District Nutrition Coordinating Committees (DNCC) that we collaborate with will disseminate the nutrition recipes beyond Africa RISING intervention sites/EPAs. We expect at 5,000 households to benefit through the DNCC scaling in Dedza District, using Africa RISING recipes (FtF 4 .5.2: value-added and processing). | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 8. How are the activities in this protocol linked to those of others? | | | | | | | | | | | | |
| Legume grain used in nutrition training and value addition is derived from CIAT implemented Sub-activity 3.2.1.2 | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 9. Gantt chart | | | | | | | | | | | | |
| See sub-activity 1.1.1.2 | | | | | | | | | | | | |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Outcome 3: Options for equitable food and feed safety, nutritional quality and income security of target smallholder families improved | | | | | | | | | | | | | | | | | | | |
| a. Output 3.2 | | | Nutritional quality due to increased accessibility and use of nutrient-dense crops by farmers improved | | | | | | | | | | | | | | | | |
| b. Activity 3.2.1 | | | Promote and deploy nutrient-rich crop varieties and livestock feed resources in target communities | | | | | | | | | | | | | | | | |
| c. Sub-activity 3.2.1.4 | | | Assess the contribution of the farming systems interventions in narrowing the food and nutrient gaps in Kongwa Kiteto and probability of smallholder farmer production to meet them | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | | |
| d. Systems research team | | | | | | | | | | | | | | | | | | | |
| Name | | | | | | Institution | | | | | Role | | | | | | | | |
| Patrick Okori | | | | | | ICRISAT (PI) | | | | | Conceptualize and design studies to answer research question  Coordinate assembly of data from both research and monitoring activities  Engage with other Africa RISING local and CGIAR partners  Collaboration on productivity data in different farming systems | | | | | | | | |
| Wanjiku Gichohi | | | | | | ICRISAT (Co-PI) | | | | | Conceptualize and design studies to answer research question  Coordinate assembly of data from both research and monitoring activities  Engage with other Africa RISING local and CGIAR partners | | | | | | | | |
| Yacinta Muzanila | | | | | | SUA (Co-PI) | | | | | Coordinate assembly of data from both research and monitoring activities | | | | | | | | |
| Job Kihara | | | | | | CIAT (Co-PI) | | | | | Collaboration on productivity data in different farming systems | | | | | | | | |
| Arkadeep Bandyopadhyay | | | | | | IFPRI/IITA (ESA M&E) | | | | | Provide support in monitoring of the research activities to ensure compliance to FtF monitoring system and uploading of data into the FtF data management system | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | | |
| e. Student(s) | | | | | | | | | | | | | | | | | | | |
| Name | | | | Institute | | | | | | Degree | | | Start | | | End | | | |
| N/A | | | |  | | | | | |  | | |  | | |  | | | |
|  | | | | | | | | | | | | | | | | | | | |
| f. Location(s): District, Village | | | | | | | Kongwa, Kiteto | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | | |
| g. Start date | | | | | | | November 2014 | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | | |
| h. End date | | | | | | | August 2020 | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | | |
| 1. Justification | | | | | | | | | | | | | | | | | | | |
| Nutrition-sensitive agriculture and food systems can contribute to improving nutrition and health outcomes, by underpinning the production of diverse, safe and nutrient-rich food as well as income generation to meet livelihood needs including health services. The impact of nutrition-sensitive agriculture, however, depends on the diversity of farming systems in relation to its food systems. Africa RISING has been promoting productivity-enhancing innovations in Kongwa and Kiteto singly and or as integrated system-based interventions. A case in point is the Moshi-Maile integrated site in Mlali, Kongwa, among other 60 farms, with whom we have worked. This study aims to assess the contribution of the SI crop and livestock productivity interventions to narrow food and nutrient gaps in Kongwa and or Kiteto and probability of smallholder farmer production to meet them. This study also seeks to address household nutrition, a major livelihood issue but starting at production and the associated technologies being promoted by the different teams as the entry point. It is part of the food system (sub-activity 5.1.1, Sub-activity 2.2.1.3, Sub-activity 1.1.2.3). Study populations will also be expanded to other 60 beneficiaries in Kongwa and Kiteto especially direct beneficiary households that accessed improved seed of legumes, cereals and poultry among others. | | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | | |
| 2. Objective | | | | | | | | | | | | | | | | | | | |
| To study whether diversifying production of household own food sources has the potential to increase dietary diversity and nutrient adequacy of vulnerable groups | | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | | | | | | | | | | |
| 3.1 To what extent does an integrated delivery of productivity-enhancing technologies (crop and livestock) increase the probability of meeting dietary diversity and nutrient adequacy of family household nutrition dietary needs? | | | | | | | | | | | | | | | | | | | |
| 3.2 To what extent does the farming system in agro-pastoral communities drive or affect food supply and consumption to meet the dietary demands of especially children, girls and women? | | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | | | | | | | | | | |
| Experiment design, implementation and data analysis: Cross-sectional study will be used to collect detailed information on dietary intake, foods available both at household level and markets, costs of the foods and possible combinations of these foods to deliver recommended daily allowance (RDA) of nutrients to different vulnerable groups. The study will use approaches such as focused group discussions (FDG), key informant interviews, participatory evaluations and individual surveys. | | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | | |
| 5. Data to be collected and uploaded on Dataverse | | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | | |
| Domain & *Indicator* | | Field/plot level metrics | | | Farm level metrics | | | | Household level metrics | | | | | Community/  landscape metrics | | | Measurement method (details in research protocol) | | |
| Human | | | | | | | | | | | | | | | | | | | |
| *Nutrition* | | *Protein Production* | | | Total protein production (g/ha) | | | | Access to nutritious food  Food consumption score  Dietary diversity | | | | |  | | | Survey | | |
|  | | Total Micronutrient production | | | Total micro-nutrient production (g/ha, availability of diverse food crops | | | | Potential/Actual protein availability | | | | |  | | | Survey, Lookup tables | | |
|  | |  | | |  | | | | Nutritional status (underweight, stunting, wasting) | | | | |  | | | Anthropometric measurements | | |
| Food security | |  | | |  | | | | Food availability, Food accessibility, Food utilization, Food security composite index | | | | | Total food production | | | Survey | | |
|  | | | | | | | | | | | | | | | | | | | |
| 6. Deliverables | | | | | | | | | | | | Means of verification | | | | | | Delivery date | |
| 6.1 Food and nutrient gaps in Kongwa/Kiteto under smallholder production systems using Africa Rising technologies established | | | | | | | | | | | | Project progress reports | | | | | | Jun. 2020 | |
| 6.2 At least one publication on food and nutrient gaps and probability of farmer- increased productivity to meet them by use of new technologies | | | | | | | | | | | | Publication in peer-reviewed journal | | | | | | Aug. 2020 | |
| 6.3 Partnership for scaling established | | | | | | | | | | | | MOU document | | | | | | Aug. 2020 | |
|  | | | | | | | | | | | | | | | | | | | |
| 7. How will scaling be achieved? N/A | | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | | |
| 8. How are the activities in this protocol linked to those of others? | | | | | | | | | | | | | | | | | | | |
| These activities are linked to the systems approach to generate evidence of the productivity effect on nutrition. It will, therefore, feed-into the systems agronomy, Gender and M&E and have a comprehensive view on the inter-linkages of Agriculture-Nutrition. | | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | | |
| 9. Gantt chart | | | | | | | | | | | | | | | | | | | |
|  | **Activity** | | | | | | | Start | | | | | | | End- | | | | Workdays |
| 1. | Conceptualize and design studies | | | | | | | Fri 11/01/19 | | | | | | | Mon 12/30/19 | | | | 42 |
| 2. | Data collection, analyses and reporting | | | | | | | Mon 6/01/20 | | | | | | | Fri 8/28/20 | | | | 65 |

## Outcome 4: Functionality of input and output markets and other institutions to deliver demand-driven sustainable intensification research products improved

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| a. Output 4 | | Access to profitable markets for smallholder farming communities and priority value chains facilitated | | | | |
| b. Activity 4.1.1 | | Conduct comprehensive value-chain analysis with specific focus on SI technologies | | | | |
| c. Sub-activity 4.1.1.1 | | Conduct value chain analysis (VCA) for (quality protein) maize seed in Kongwa and Kiteto | | | | |
|  | | | | | | |
| d. Systems research team: | | | | | | |
| Name | | | | Institution | Role | |
| Bright Jumbo | | | | CIMMYT | PI | |
| Patrick Okori/James Mwololo | | | | ICRISAT | To work closely on similar ICRISAT led VCA for cereals (Sorghum) and legumes (groundnuts) | |
| Anicet Sambala | | | | IITA | To support in monitoring of the research activities to ensure compliance with the FtF monitoring system including periodically assisting in data collection (both FtF and Custom indicators data) with a critical gender perspective and uploading into the FtF system | |
| Gundula Fischer | | | | IITA | To provide guidance on gender when designing tools (questionnaires) for the maize value chain study that are gender inclusive | |
| Field activities were concluded during the [last experiment year](http://africa-rising-wiki.net/File:ESA_workplan_2018-2019.pdf) and reported on. A manuscript is being prepared; 1st draft expected during June 2020. | | | | | | |
|  | | | | | | |
| Outcome 4: Functionality of input and output markets and other institutions to deliver demand-driven sustainable intensification research products improved | | | | | | |
| a. Output 4.1 | | | Access to profitable markets for smallholder farming communities and priority value chains facilitated | | | |
| b. Activity 4.1.1 | | | Conduct comprehensive value-chain analysis with specific focus on SI technologies | | | |
| c. Sub-activity 4.1.1.2 | | | Value chain analysis of groundnut seed and design of operation enhancement strategies for semi-arid ecologies of central Tanzania | | | |
|  | | | | | | |
| d. Systems research team: | | | | | | |
| Name | Institution | | | | | Role |
| James Mwololo | ICRISAT (PI) | | | | | Coordinate assembly of data from both research and monitoring activities. Engage with other Africa RISING local and CGIAR partners |
| Anicet Sambala | IITA | | | | | To support the monitoring of the research activities to ensure compliance to FtF monitoring system, including periodically assisting in data collection (both FtF and Custom indicators data) with a critical gender perspective and uploading of data into the FtF data management system |
| Extension officers | DAICOs-Iringa, Kiteto, Kongwa | | | | | Support the survey teams (enumerators) as appropriate |
| Field activities were concluded during the [last experiment year](http://africa-rising-wiki.net/File:ESA_workplan_2018-2019.pdf) and reported on. A manuscript is being prepared; 1st draft expected during June 2020. | | | | | | |

## Outcome 5: Partnerships for the scaling of sustainable intensification research products and innovations operationalized

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| a. Output 5.1 | | | Opportunities for the use and adoption of sustainable intensification technologies identified for relevant farm typologies | | |
| b. Activity 5.1.1 | | | Farmer participatory experimentation with crop and soil management and integrated crop-livestock technologies in on-farm situations | | |
| c. Sub-activity 5.1.1.1 | | | Continued experimentation in 6 target communities of Eastern Zambia and 9 target communities in central and southern Malawi with already established clustered CA trials | | |
|  | | | | | |
| d. Systems research team | | | | | |
| Name | | | | Institution | Role |
| Christian Thierfelder | | | | CIMMYT | PI, research conceptualization, design, bio-physical research |
| Munyaradzi Mutenje | | | | CIMMYT | Socio-economic research |
| Richard Museka | | | | TLC | Implementation and scaling |
| Mphatso Gama | | | | Machinga ADD | Implementation and scaling |
| Mulundu Mwila | | | | ZARI | Implementation and scaling |
|  | | | | | |
| e. Students: Nil | | | | | |
|  | | | | | |
| f. Locations | Hoya, Vuu, Kapara, Mtaya, Chanje, Kawalala in Eastern Zambia  Mwansambo, Zidyana, Chinguluwe, Chipeni, Lemu, Herbert, Malula, Matandika, Songani in Malawi | | | | |
|  | | | | | |
| g. Start date | | This is a continuing multi-year study which has been running since 2011 in Zambia and since 2004/2005 in Southern and Central Malawi | | | |
|  | | | | | |
| h. End date | | November 2021 | | | |
|  | | | | | |
| 1. Justification | | | | | |
| Southern African Smallholder farming communities are affected by climate change and soil fertility decline. More sustainable agriculture intensification practices need to be developed that cushion smallholder against the adversities of climate. We established CA long-term trials with different diversification strategies in 16 target communities of Malawi and Zambia to find out its effects on productivity and environment and in a sister activity (5.1.7.1). | | | | | |
|  | | | | | |
| 2. Objectives | | | | | |
| To demonstrate the best options available at the moment for the management of drought-tolerant maize varieties and conservation agriculture practices in 15 target communities of Malawi and Zambia. Conservation agriculture is understood to imply surface crop residue retention, minimum soil disturbance and crop rotation. Both animal traction and manual systems will be tested. | | | | | |
|  | | | | | |
| 3. Research questions | | | | | |
| 3.1 What is the effect of the Conservation Agriculture diversification strategies on productivity, the environment and other farm activities? | | | | | |
|  | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | |
| Experiment design, implementation and data analysis:  The trials will be established in clustered on-farm trials (6 trials per community) with farmers as replicates. In total there will be 15 different target communities | | | | | |
|  | | | | | |
| 5. Data (with indicators and metrics) to be collected and uploaded on Dataverse | | | | | |

|  |  |  |  |
| --- | --- | --- | --- |
| SI Domain & *Indicator* | Field/plot level metrics | Farm level metrics | Measurement method |
| Productivity | | | |
| *Crop productivity* | Yield (kg/ha/season); |  | Crop cuts and detailed yield measurement |
| *Crop biomass productivity* | Residue production (kg/ha/season) |  | Crop cuts and detailed yield measurement |
| Economic | | | |
| Data taken in 5.1.7.1 |  |  |  |
| Environment | | | |
| *Soil biology* | Total Carbon (%) |  | Soil analysis in laboratory |
| *Erosion* | Rating of erosion | Rating of erosion | Farmer rating |
| Social | | | |
| Data taken in 5.1.7.1 |  |  |  |
| Human | | | |
| Data taken in 5.1.7.1 |  |  |  |

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| --- | --- | --- |
|  | | |
| Other domains (social and human domains will be collected in 5.1.7.1 – socio-economic research in target communities) | | |
|  | | |
| 6. Deliverables | Means of verification | Delivery date |
| 6.1 Trials designed and protocols updated | Protocol available | Nov. 2019 |
| 6.2 Trials established | Technical report | Mar. 2020 |
| 6.3 Monitoring | Field tours, report | Apr. 2020 |
| 6.4 Data generated and uploaded | Report | Sep. 2020 |
| 6.5 10,000 farmers actively participating in promotion and extension activities | Adoption monitoring report | Sep. 2020 |
| 6.6 Upload data into Dataverse | Data uploaded | Sep. 2020 |
|  | | |

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| 7. How will scaling be achieved? |
| * Malawi and Zambian extension system at district level (e.g. the District Agricultural Extension Coordinating Committees: DAECC in Malawi) is a prime vehicle for disseminating improved CA technologies to other EPAs and districts. Ministry of Agriculture Extension service will continue supporting CIMMYT in scaling activities. TLC is a prime extension partner who has scaled CA to more than 200,000 farmers. * CIMMYT will get evidence of all programs that currently promote CA scaling in the region and summarize these to better understand what scaling technologies work, what enablers are fruitful and what regulatory fosters the outscaling of these systems. Our prime scaling partner TLC will be interviewed, and lessons learned documented. |
|  |
| 8. How are the activities in this protocol linked to those of others? |
| Data from CA on-farm trial are important in the Maize-Legume system assessment done by MSU and CIMMYT will collaborate more intensely with this group. |
|  |

9. Gantt chart

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Activity** | **2019** | | | **2020** | | | | | | | | |
| **Oct** | **Nov** | **Dec** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** |
| Planning and contracting |  |  |  |  |  |  |  |  |  |  |  |  |
| Development of subgrants with partners |  |  |  |  |  |  |  |  |  |  |  |  |
| Procurement of inputs |  |  |  |  |  |  |  |  |  |  |  |  |
| Trial implementation |  |  |  |  |  |  |  |  |  |  |  |  |
| Selection of sites for MSc study |  |  |  |  |  |  |  |  |  |  |  |  |
| Monitoring and evaluation |  |  |  |  |  |  |  |  |  |  |  |  |
| Bio-physical data taking |  |  |  |  |  |  |  |  |  |  |  |  |
| Case studies |  |  |  |  |  |  |  |  |  |  |  |  |
| Socio-economic surveys |  |  |  |  |  |  |  |  |  |  |  |  |
| Field and study tours to target communities |  |  |  |  |  |  |  |  |  |  |  |  |
| Student supervision |  |  |  |  |  |  |  |  |  |  |  |  |
| Writing of bi-annual report |  |  |  |  |  |  |  |  |  |  |  |  |
| Field days and evaluation meetings |  |  |  |  |  |  |  |  |  |  |  |  |
| Collection of field data |  |  |  |  |  |  |  |  |  |  |  |  |
| Analysis of field data |  |  |  |  |  |  |  |  |  |  |  |  |
| Evaluation meetings in country |  |  |  |  |  |  |  |  |  |  |  |  |
| Data upload into Dataverse |  |  |  |  |  |  |  |  |  |  |  |  |
| Africa RISING meeting |  |  |  |  |  |  |  |  |  |  |  |  |

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| Outcome 5: Partnerships for the scaling of sustainable intensification research products and innovations operationalized | | | | | | | | | | | | | | | |
| a. Output 5.1 | | | | | | Opportunities for the use and adoption of sustainable intensification technologies identified for relevant farm typologies | | | | | | | | | |
| b. Activity 5.1.1 | | | | | | Farmer participatory experimentation with crop and soil management and integrated crop-livestock technologies in on-farm situations | | | | | | | | | |
| c. Sub-Activity 5.1.1.2. | | | | | | Explore the productivity domains of selected legumes and cereals to elucidate their best fitting cropping system at community/landscape level and their dissemination | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| d. Research team | | | | | | | | | | | | | | | |
| Name | | | | | | | Institution | | | | Role | | | | |
| Patrick Okori | | | | | | | ICRISAT (PI) | | | | Coordinate the assembly of data from both research and monitoring activities | | | | |
| Mawazo J. Shitindi | | | | | | | SUA | | | | Co-PI at the Mlali Moshi-Maile site on sub-activity 5.1.3.3, objective 3, “evaluating the effect of in situ rainwater harvesting (tied ridges) and fertilizer micro-dosing on water and nutrient use efficiency of maize-pigeon pea and maize-groundnut systems.” No extra budget is needed | | | | |
| Francis Muthoni | | | | | | | IITA | | | | Support generation of exploration map to inform scaling-out potential regions beyond action sites in Tanzania | | | | |
| Arkadeep Bandyopadhyay | | | | | | | IFPRI/IITA (ESA M&E) | | | | Provide support in monitoring of research activities to ensure compliance to FtF monitoring system, including periodically assisting in data collection (both FtF and Custom indicators data) and uploading of data into the FtF data management system | | | | |
| TARI technicians/ Extension officers | | | | | | | TARI-Naliendele, TARI-Hombolo, TARI-Ilonga, DAICO staff of Iringa, Kiteto, Kongwa districts. | | | | Backstop field days and other limited field monitoring activities as required | | | | |
|  | | | | | | | | | | | | | | | |
| e. Students | | | | | | | | | | | | | | | |
| Name | | | | | Institute | | | | | | Degree | | Start | | End |
| Simon Wabwire | | | | | Sokoine University of Agriculture | | | | | | MSc in Crop Science | | November 2018 | | July 2020 |
|  | | | | | | | | | | | | | | | |
| f. Locations District | | | | Kongwa District, Villages-Chitego, Mlali, Laikala Moleti Laikala Moleti; Kiteto District- Villages-Njoro or Kiperesa and Iringa District, Village-Igula | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| g. Start date | | November 2018 | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| h. End date | | September 2020 | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 1. Justification | | | | | | | | | | | | | | | |
| During the 2013-to 2016 cropping seasons, we evaluated several elite materials to identify candidates for release/ commercialization. Some of these materials have already been released and others proposed for release. In the 2018-2019 cropping season, experiments were conducted to test adaptability to sub-agro-ecologies (Mega environments that had been identified). Because 2018-2019 was very variable and environmentally stressful there is a need to validate the results. The data we generated support presence of micro-niches with crop and variety adaptation. We plan to complete these studies by conducting a second cropping experiment, to refine our target population of environments that will guide the deployment of new varieties in the appropriate sub-environments. For example, so far, we find two major environments i.e., Mlali and Manyusi in Kongwa as a unique being optimal environments for our test crops, and other rest of the test sites being low-performance areas for test crops irrespective of the crop management system used.  At the joint site (Mosh-Maile in Mlali Kongwa), we will work with SUA to test the performance of these technologies in our sub-ecologies, while integrating soil, water and weather interactions. ICRISAT will supply the plant material (improved seed), while SUA and ICRISAT will mount trials as mutually agreed upon.  We are going to work with the IITA GIS expert to support the generation of extrapolation map to regions beyond our action sites to gain comprehensive insights of where the tested technologies can be replicated in Tanzania. | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | | | | | | |
| 2.1 To evaluate the performance of elite legume (groundnut and pigeon pea) and elite cereal (sorghum and pearl millet) varieties under-stressed, moderately stressed conditions in central Tanzania | | | | | | | | | | | | | | | |
| 2.2 To identify and validate intercropping systems (varieties and agronomy) for semi-arid agro-ecologies in Kongwa, Kiteto and Iringa | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | | | | | | |
| 3.1 How do the varieties and associated technologies affect the livelihood choices and options adopted by farming communities? | | | | | | | | | | | | | | | |
| 3.2 What is the scalability of the test technologies to other ecologies within Tanzania and beyond? | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | | | | | | |
| Experiment design, implementation and data analysis:  Two experiments will be conducted to inform the integration of highly productive legume and cereal genotypes into the cropping systems of semi-arid central Tanzania. A mother-baby, a participatory study approach is being used. A total of 4 crops (maize, sorghum, pearl millet, pigeon pea and groundnut) will be evaluated for a second cropping season. In each crop, we will maintain the number of test varieties (3-4) and evaluated against the local landrace. The trials will be conducted both under stressed and non-stressed environments. The plot size is 6 rows, 8 m long spaced at 75 cm between ridges.  The cereals and legumes material identified through GGE biplots, as suitable for highly productive environments such as the Moshi-Maile site, will be validated along with other complementary ISFM technologies being tested by the soil team and other Africa RISING scientists. Productivity of the system will be modelled along with data generated for other sites in which the Moshi-Maile site will be a test environment and the low productivity sites and moderate sites as well, used as controls for agriculture production simulator modelling (APSIM). | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 5. Data to be collected and uploaded on Dataverse | | | | | | | | | | | | | | | |
| Domain & *Indicator* | | Field/plot level metrics | | | | | Farm level metrics | | Household level metrics | | Community /landscape metrics | | Measurement method | |
| Productivity | | | | | | | | | | | | | | |
| *Grain yield* | | Yield (kg/ha/season) | | | | | Yield (kg/ha/season) | |  | |  | | Yield measurement | |
| *Crop biomass productivity* | | Residue production (Kg/ha/season) | | | | | Residue production (Kg/ha/season) | |  | |  | | Yield measurement | |
| Economic | | | | | | | | | | | | | | |
| *Profitability* | | Net income ($/crop/ha/season) | | | | | Net income (Total net income for all farm activities) | |  | |  | | Participatory Evaluation | |
| *Labor requirement* | | Labor requirement (hours/ha) | | | | | Labor requirement (hours/ha) | |  | |  | | Direct observation/farmer evaluation | |
| Human condition | | | | | | | | | | | | | | |
| *Capacity to experiment* | |  | | | | |  | | No. of new practices being tested | |  | | Focus group discussion | |
| *Nutrition* | |  | | | | | Protein production (g/ha) | |  | |  | | Conversion using Lookup tables | |
| *Food security* | |  | | | | | Food production (calories/ha) | |  | |  | | Conversion using Lookup tables | |
| Social | | | | | | | | | | | | | | |
| *Equity* | | Rating of technologies by group, Capacity to access information | | | | | Rating of technologies by group, Capacity to access information | |  | | Participation in social groups | | Participatory Evaluation/key informant interview | |
| *Social cohesion* | | Participation in community activities | | | | | Participation in community activities | | Participation in community activities | |  | | Key informant interviews, Focus group discussions | |
|  | | | | | | | | | | | | | | |
| 6. Deliverables | | | | | | | | | Means of verification | | | | | Delivery date. | |
| 6.1 Performance of superior varieties in target communities established to inform scaling-up and technology integration | | | | | | | | | Project progress report best-adapted varieties for the focus ecologies (grain yield, net economic benefits) and draft manuscript for publication in peer-reviewed Journal | | | | | Sep. 2020 | |
| 6.2 Performance of different legume-cereal cropping systems in three sub-ecologies of the Semi-Arid zone of central Tanzania established | | | | | | | | | Project progress report and draft manuscript for publication in peer-reviewed Journal | | | | | Sep. 2020 | |
| 6.3 Capacity for testing involving technology end-users established | | | | | | | | | Project progress reports indicating partners involved, number of farmers directly hosting trials, field days and exposure events held | | | | | Sep. 2020 | |
| 6.4 Reach 2,000 farmers through 5 test-site based field days in addition to those under sub-activity 5.2.2.1 on scaling out seed | | | | | | | | | Field day reports | | | | | Sep. 2020 | |
|  | | | | | | | | | | | | | | | |
| 7. How will scaling be achieved | | | | | | | | | | | | | | | |
| *Partnerships:* Building on the partnerships with TARI Institutes (Naliendele and Ilonga) we are going to use the platform to engage more development partners such as the World Food Programme to reach scale. Seed will be rolled out via informal systems in partnership with Dodoma Agricultural Seed Producers’ Association (DASPA), a community based organized in production of quality declared seed to ensure availability of quality seed to farmers in Central Tanzania. This links to sub-activity 5.2.2.1.  *Knowledge dissemination*: Through field days and promotional campaigns in all test sites to reach at least 2,000 farmers. | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 8. How are the activities in this protocol linked to those of others? | | | | | | | | | | | | | | | |
| A multi-team participation will be used to leverage on complementarities and to explore the synergies:   1. GIS (IITA) team will be leveraged for site and environmental mapping (sub-activity 1.3.1.2). 2. Soil and water conservation (Hombolo) and integrated soil fertility management (SUA) teams involved at the Moshi-Maile-site in Mlali for shared results on variety performance as influenced by ISFM technologies (sub-activity 2.2.1.6 and sub-activity 2.2.1.5, sub-activity 5.1.3.3). 3. System Agronomist (IITA) provide the data on sites in Mlali, (as part of the Moshi-Maile integrated site studies). | | | | | | | | | | | | | | | |
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9. Gantt chart

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| --- | --- | --- | --- | --- |
|  | **Activity** | Start | End | Workdays- |
| 1. | Soil sample collection | Tue 12/03/19 | Mon 3/30/20 | 85 |
| 2. | Data collection and analysis | Wed 1/01/20 | Fri 7/31/20 | 153 |
| 3. | Field monitoring | Fri 1/03/20 | Thu 4/30/20 | 85 |
| 4. | Laboratory analysis | Mon 12/02/19 | Fri 7/31/20 | 175 |
| 5. | Report and write up | Mon 8/03/20 | Tue 9/15/20 | 32 |

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| Outcome 5: Partnerships for the scaling of sustainable intensification research products and innovations operationalized | | | | | | |
| a. Output 5.1 | | Opportunities for the use and adoption of sustainable intensification technologies identified for relevant farm typologies | | | | |
| b. Activity 5.1.2 | | Use farm trial data to apply crop simulation models (APSIM) and assess performance over space and time, including assessment of climate-smart technologies to establish the potential for adaptation and mitigation | | | | |
| c. Sub-Activity 5.1.1.3 | | Engage development partners to identify technologies of interest for partnership dissemination | | | | |
|  | | | | | | |
| d. Research team | | | | | | |
| Name | | | Institution | | Role | |
| Ben Lukuyu | | | ILRI | | PI | |
| Leonard Marwa | | | ILRI | | Technical backstopping on preparing and delivering livestock messages | |
| Extension staff | | | Babati District | | Monitor and provide intelligence about partner activities | |
| Development partners | | | World Vision, COSITA, FIDE | | Capacity building using our training materials | |
|  | | | | | | |
| e. Students: Nil | | | | | | |
|  | | | | | | |
| f. Locations | All villages, Babati District | | | | | |
|  | | | | | | |
| g. Start date | 2017 | | | | | |
|  | | | | | | |
| h. End date | 2020 | | | | | |
|  | | | | | | |
| 1. Justification | | | | | | |
| This activity will major involve one-on-one meetings with development partners whom we have already identified through our previous stakeholder meetings, to identify which technology/gies they are interested in / or are currently engaged in and would like to take to scale (including financially supporting the process). Once these are identified, Africa RISING will define detailed plans and explore the potential to develop MoUs that will outline activities and expected deliverables. | | | | | | |
|  | | | | | | |
| 2. Objectives | | | | | | |
| 2.1 To plan and roll out various livestock scaling activities with partners | | | | | | |
|  | | | | | | |
| 3. Research questions | | | | | | |
| Not applicable | | | | | | |
|  | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | |
| Experiment design, implementation and data analysis:  ILRI’s role will be to develop the Development Partners’ capacity in the ability to understand, demonstrate and scale the technology and back-stop their scaling if necessary, and address research needs as they are identified in the process. | | | | | | |
|  | | | | | | |
| 5. Data (with metrics) to be collected and uploaded on Dataverse: N/A | | | | | | |
|  | | | | | | |
| 6. Deliverables | | | | Means of verification | | Delivery date |
| Meetings with selected partners | | | | Meeting reports and activity outlines for partners | | Aug. 2020 |
| Monitoring of training activities | | | | Training reports from partners | | Aug. 2020 |
| Number of technologies taken to scale | | | | FtF report | | Aug. 2020 |
| Long-term partnership established | | | | MoU | | Aug. 2020 |
|  | | | | | | |
| 7. How will scaling be achieved? N/A | | | | | | |
|  | | | | | | |
| 8. How are the activities in this protocol linked to those of others? N/A | | | | | | |
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| Outcome 5: Partnerships for the scaling of sustainable intensification research products and innovations operationalized | | | | | | | | | | | | | | | |
| a. Output 5.1 | | | | Opportunities for the use and adoption of sustainable intensification technologies identified for relevant farm typologies | | | | | | | | | | | |
| b. Activity 5.1.1 | | | | Farmer participatory experimentation with crop and soil management and integrated crop-livestock technologies in on-farm situations | | | | | | | | | | | |
| c. Sub-activity 5.1.1.4 | | | | Case studies: Application of SI technologies use among farmers interacting with Africa RISING at different intensities | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| d. Systems research team | | | | | | | | | | | | | | | |
| Name | | | | | Institution | | | | Role | | | | | | |
| Sieg Snapp, Regis Chikowo | | | | | MSU | | | | Research design, supervision of fieldwork and MSc student | | | | | | |
| Christian Thierfelder | | | | | CIMMYT | | | | Research design, supervision of fieldwork and MSc student | | | | | | |
| Wezi Mhango | | | | | LUANAR | | | | Fieldwork, MSc student supervision | | | | | | |
| Rowland Chirwa | | | | | CIAT | | | | Bean intensification component | | | | | | |
|  | | | | | | | | | | | | | | | |
| e. Students | | | | | | | | | | | | | | | |
| Name | | | | | | Institute | | | | Degree | | Start | | | End |
| Two students to be recruited (CIMMYT and MSU) | | | | | | LUANAR | | | | MSc | | Oct. 2019 | | | Sep. 2021 |
|  | | | | | | | | | | | | | | | |
| f. Locations | | Golomoti, Kandeu, Linthipe (MSU led long-term experiments in these EPAs);  Lemu, Matandika Songani (CIMMYT led long-term experiments in these EPAs) | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| g. Start date | | October 2019 | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| h. End date | | September 2021 | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 1. Justification | | |  | | | | | | | | | | | | |
| Africa RISING MSU led component started interacting with farmers during the 2012/13 cropping season in three agro-ecologies in central Malawi. CIMMYT started interacting with farmers that have been using CA-based SI technologies since the 2007/2008 cropping season in three agro-ecologies in central Malawi. Trials from both MSU and CIMMYT led trials will be selected. Over time, some new farmers were engaged, creating an opportunity to also study exposure time as a factor to understand the intensity and use of SI technologies. Farmers were primarily engaged at different levels, which are, hereafter referred to as the ‘treatments’.   1. Mother trial farmers: these are farmers who hosted fully replicated trials with a range of technologies, often more than 8 treatments. They are a nucleus group of farmers, who anchor the learning process. They are more visited by researchers and often host field days. Farmer interaction with researchers and extension is rated as ‘high’. Three mother trials per agro-ecology will be selected for the determination of water-limited yield potential. 2. Mother trial farmer experimenter: these are the same host farmers who are applying SI technologies on their wider farm. Three fields will be selected to capture yield data from these. 3. Baby farmers: These are a selected group of farmers who are associated with a mother trial. These farmers usually participate in field days and engage extension staff. 4. Local controls: These farmers are located in the same village as the mother and baby trial farmers. They do not directly benefit from Africa RISING but are exposed to Africa RISING technologies through field days. They often do not directly relate to the project. At least 3 local controls per mother (3x3=9 farmers per agro-ecology).   The mother trials are often planted on time, with the best agronomic practices (fertilizer management, appropriate rotations, soybean inoculation with good bacteria strain, weeding, etc.). We hypothesize that crop productivity on mother trials typically represent water-limited yield potential for the different agro-ecologies. These crop yield will be used as benchmarks to assess the level of intensification at farm-scale for the three farmers’ groups (II, III and IV).  This activity will profile technologies of farmers and assess the impact at farm-scale. We hypothesize that mother trial farmers are more likely to adopt more technologies as they more closely interact with a range of SI technologies on the mother trials. We will investigate whether these farmers with more SI technologies are also more resilient to shocks. Through this sub-activity, we will be able to give feedback on SI technologies and their use firmly anchored on empirical evidence from the detailed whole-farm systems analysis. This would feed into policy discussions. | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | | | | | | |
| 2.1 To determine differentials in farm-scale uptake off SI technologies for mother trial host farmers, baby trial farmers and farmers not directly participating in Africa RISING activities | | | | | | | | | | | | | | | |
| 2.2 To determine the effect of farm typology of adoption of SI technologies | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | | | | | | |
| 3.1 How do Africa RISING technologies diffuse among farmers with different degrees of contact with researchers? | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | | | | | | |
| Experiment design, implementation and data analysis:  Three mother trial host farmers, three baby trial farmers and three non-participating farmers will be profiled in each of the three EPAs for MSU and CIMMYT led trials. Crop yields will be determined for the following situations:   * + - * Mother trials: crop yields will be determined on the mother trials, as has been done over the years since trials were implemented. The mother trials are optimally established. The yields from these trials are a good estimate of the potential for the different technologies in different environments. This yield level is ecologically referred to as water-limited yield potential.       * Mother trial farmer’s own farm       * Baby trial farmer’s whole farm SI application (3 baby trial farmers per mother trial, to also cover farm typologies)       * Control farmer: 3 farmers close to a mother trial, to also cover farm typologies   In total, there will be (9 farmers, 12 data points per site x 3 sites=36 data points). | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 5. Data (with metrics) to be collected and uploaded on Dataverse | | | | | | | | | | | | | | | |
| Domain & *Indicator* | | Field/plot level metrics | | | | | Farm level metrics | | | Household level metrics | | | Measurement method | |
| Productivity | | | | | | | | | | | | | | |
| *Maize grain productivity* | | Maize grain and biomass yield (kg/ha/season) | | | | | total farm production (kg/ha/farm) | | |  | | | Yield measurements | |
| *Maize biomass productivity* | | Legume grain and biomass yield (kg/ha/season | | | | |  | | |  | | | Yield measurements | |
| *Yield gap* | | Yield gap for maize, and grain legumes (kg/ha/season) | | | | |  | | |  | | | Yield measurements | |
| Economic | | | | | | | | | | | | | | |
| *Profitability* | | Net income ($/crop/ha/season),  Gross margin | | | | |  | | |  | | | Survey | |
| Environmental | | | | | | | | | | | | | | |
| *Soil biology* | | Soil organic carbon (g/kg) | | | | |  | | |  | | | Laboratory analysis | |
| *Soil chemical quality* | | Biological N2-fixation(kg/ha) | | | | | Biological N2-fixation(kg/farm) | | |  | | | Direct measurement | |
| Human condition | | | | | | | | | | | | | | |
| *Nutrition* | | Protein production (g/ha) | | | | |  | | |  | | | Lookup tables | |
| *Food security* | | Food production  (calories/ha/year) | | | | |  | | | Months of food insecurity | | | Lookup tables, survey\* | |
| Social | | | | | | | | | | | | | | |
| *Gender equity* | | Rating of technologies by gender | | | | |  | | |  | | | Participatory evaluation | |
| *Social cohesion* | |  | | | | |  | | | Participation in community activities | | | Focus group discussions | |
|  | | | | | | | | | | | | | | | |
| 6. Deliverables | | | | | | | Means of verification | | | | | | Delivery date | | |
| 6.1 Detailed protocol finalized | | | | | | | Data collection protocol available | | | | | | Oct. 2019 | | |
| 6.2 Data sets by farm typologies; estimates of yield gaps; farm-scale SI scaling | | | | | | | Excel files, raw field data | | | | | | May 2020 | | |
| 6.3 Data combined and uploaded on Dataverse | | | | | | | Data files, reports | | | | | | Sep. 2020 | | |
|  | | | | | | | | | | | | | | | |
| 7. How will scaling be achieved? | | | | | | | | | | | | | | | |
| Scientific publication in an appropriate agricultural systems journal for wider dissemination to the scientific community. | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 8. How are the activities in this protocol linked to those of others? | | | | | | | | | | | | | | | |
| Mother and baby trials will be chosen from work implemented by MSU and CIMMYT. | | | | | | | | | | | | | | | |

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| Outcome 5: Partnerships for the scaling of sustainable intensification research products and innovations operationalized | | | | | | | | | | | | |
| a. Output 5.1 | | | | Opportunities for the use and adoption of sustainable intensification technologies identified for relevant farm typologies | | | | | | | | |
| b. Activity 5.1.2 | | | | Use farm trial data to apply crop simulation models (APSIM) and assess performance over space and time, including assessment of climate-smart technologies to establish the potential for adaptation and mitigation | | | | | | | | |
| c. Sub-Activity 5.1.2.1 | | | | Apply APSIM crop simulation model to assess changes in resource use efficiencies, productivity and profitability of the different cropping systems in Kongwa, Kiteto and Iringa in Tanzania | | | | | | | | |
|  | | | | | | | | | | | | |
| d. Systems research team | | | | | | | | | | | | |
| Name | | | Institution | | | Role | | | | | | |
| Patrick Okori | | | ICRISAT | | | PI | | | | | | |
| Amos Ngwira | | | ICRISAT | | | Co-PI: Coordinate assembly of data from both research and monitoring activities. Engage with other Africa RISING agronomists for cross-site studies | | | | | | |
| Mawazo J. Shitindi | | | SUA | | | Co-PI for weather variables data assembly for modelling in sub-activity 1.1.1.7 He will also be part of objective 3, of sub-activity 5.1.3.3.” No extra budgets are needed | | | | | | |
| Anthony Kimaro | | | ICRAF | | | As the lead researcher for this activity, he will through sub-activity 1.1.1.5 provide data for APSIM modelling from studies on productivity and resilience benefits of Gliricidia-based cropping systems | | | | | | |
| Regis Chikowo | | | MSU | | | As the lead researcher for this activity, he will through sub-activity: 1.1.1.2 support APSIM modelling by providing access to data on quantified medium to long term impacts of SI technologies (improved soil fertility management, improved germplasm, crop combinations, nutrient and water management) on crop productivity on multi-locational fields sites and baby trials in Malawi. Integration of the data of this activity with that of central Tanzania in the application of APSIM will bring out the regional perspective | | | | | | |
| IFPRI | | | IFPRI/IITA (ESA M&E) | | | M&E support | | | | | | |
| TARI technicians/ Extension officers | | | ARI Hombolo/ Iringa, Kiteto, Kongwa, DAICO offices | | | Backstop field days and other limited field monitoring activities as required | | | | | | |
|  | | | | | | | | | | | | |
| e. Students: Nil | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| f. Location(s): District, Village | | | Kongwa District, Villages-Chitego, Mlali, Laikala and Moleti; Kiteto District- Villages-Njoro or Kiperesa and Iringa District, Village-Igula | | | | | | | | | |
|  | | | | | | | | | | | | |
| g. Start date | | | November 2018 | | | | | | | | | |
|  | | | | | | | | | | | | |
| h. End date | | | September 2020 | | | | | | | | | |
|  | | | | | | | | | | | | |
| 1. Justification | | | | | | | | | | | | |
| This study proposed for a second year aims to gain a better understanding to inform technology deployment to de-risk smallholder farmers of dryland ecologies such as central Tanzania. These farmers must cope with declining soil fertility and increasing common droughts and in-seasonal dry-spells. In the 2018-2019 cropping season, we used soil and crop yield data from farmer participatory trials to parameterize Agricultural Production Systems Simulator (APSIM) and evaluate its performance in simulating (1980-2019) observed treatments in Iringa, Kiteto and Kongwa districts of central Tanzania. To validate this, more data will be collected from experiments in sub-activity 5.1.1.2, Objective 2. Local weather variables for modelling will be assembled with the support of SUA that is managing the automatic weather stations under sub-activity 1.1.1.7. This activity will also benefit from sub-activity 5.1.3.3 and extended to sub-activity 1.1.1.5.  To have a more regional perspective, data from the Malawi experiments will be used leveraging on and working with the MSU team that is based in Malawi. The work will also be extended to modelling crop performance and sustainability of the Gliricidia-based cropping system implemented by ICRAF in Kongwa and Kiteto.  In the 2018-2019 cropping season, a calibrated model was used to simulate pigeon pea-groundnut intercropping, pigeon pea-sorghum intercropping, pigeon pea-pearl millet intercropping under a range of management practices. Yield data was generated from three experimental sites. APSIM was parameterized using soil data generated by ISRIC soil grids. Soil water characteristics, bulk density and % soil organic matter using SPAW model. Daily rainfall data was obtained using rain gauges at each study site while temperature and solar radiation were obtained from NASA power. The key results informing a second season data are presented below:   1. Simulated cereal (sorghum and pearl millet) and legume (pigeon pea and groundnut) grain yields, approximated the observed yields showing that APSIM can predict cereal response to intercropping. The second season of trials is needed to validate these results. 2. In the low potential sites e.g. Igula, Iringa, pigeon pea grain yields reduced by 30% when intercropped with sorghum, especially where long-duration pigeon pea cultivars were used was used suggesting that varietal phenology is critical. 3. In pigeon pea and groundnut doubled-up cropping systems, the simulated results show that the faster-establishing groundnut used up the majority of available water resources especially under drought as was experienced in 2018-2019 cropping season before slow-establishing pigeon pea, resulting in reduced pigeon pea yields, especially for the long duration material. Thus, productivity can inadvertently be affected by crop and variety compatibility. 4. Total soil organic C simulated in the top 15 cm of soil increased during our study (1980-2019) especially when pigeon pea was added to the cropping system signifying the importance of grain legumes in sequestering soil C and eventual sustainability of the cropping systems. Further experimentation and validation of this finding is needed to inform the deployment of appropriate management systems for cereal-legume production that enhances productivity and farming household resilience.   At the joint site (Mosh-Maile in Mlali), we will work with SUA to assemble meteorological and soil data, while ICRISAT will mount trials as mutually agreed upon. The IITA system agronomist will also engage in data assembly and synthesis of information coming-out from the data being generated especially at the integration site. | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | | | |
| 2.1 To calibrate and validate APSIM model to predict the yield of improved varieties of cereals and legumes using data generated through on-farm experimentation | | | | | | | | | | | | |
| 2.2 To assess the long-term implications of sustainable intensification options on climate and market risks and resource use efficiency of smallholder farms in central Tanzania and Malawi | | | | | | | | | | | | |
| 2.3 Identify and propose proven climate-resilient practices which will be applied to enhance the resilience of the cereal and legume value chains to climate change and help to minimize climate risks and stabilize production and yields | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | | | |
| 3.1 To what extent does APSIM model predict the performance of doubled-up legume systems and cereal-legume intercrops in stressed and moderate stressed environments of central Tanzania and central and southern Malawi? | | | | | | | | | | | | |
| 3.2 To what extent does the use of improved drought-tolerant and nutrient-dense varieties in semi-arid environments influence water and nutrient use efficiencies of farming systems? | | | | | | | | | | | | |
| 3.3 What is the long-term implication of using improved drought-tolerant varieties in minimizing climate and market risks in the face of increased weather variability? | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | | | |
| Experiment design, implementation and data analysis:  Preliminary data for model calibration and validation was generated from on-farm experiments during the cropping year (2018-2019), to inform the integration of improved cereal and legume varieties under appropriate management. Specifically, the pigeon pea doubled-up legume systems in cereal-legume rotations was studied. The second year of data collection (2019-2020 cropping season) is needed. The data will be included in long-term simulations using long-term climatic data. This effort will lead to the assessment of changes in the resource base, resource use efficiencies, productivity and profitability of the different cropping systems in central Tanzania. Scenarios would include grouping cropping systems into climate variability, agro-ecological zones, soils and management.  In Malawi, APSIM will be parameterized using crop yield data from farmer participatory trials to evaluate its performance in simulating observed treatments at three locations in central Malawi. The calibrated model will be used to simulate groundnut-pigeon pea intercropping, maize-pigeon pea intercropping and maize-groundnut rotation, soybean-maize rotation and continuous maize under a range of N fertilizer inputs. | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 5. Data to be collected and uploaded on Dataverse | | | | | | | | | | | | |
| Domain & *Indicator* | | Field/plot level metrics | | | | Farm level metrics | | | Measurement method | | |
| Productivity | | | | | | | | | | | |
| *e.g. Crop (Pearl* millet, sorghum, pigeon pea and groundnut*) productivity* | | Yield (kg/ha/season) | | | | Yield (kg/ha/season) | | | Yield measurement | | |
| *e.g. Crop (Pearl* millet, sorghum, pigeon pea and groundnut*) biomass productivity* | | Residue production (Kg/ha/season) | | | | Residue production (Kg/ha/season) | | | Yield measurement | | |
| *Variability of production* | | Coefficient of variability  Probability of low productivity | | | | Coefficient of variability  Probability of low productivity | | | Productivity over time using simulated data | | |
| Economic | | | | | | | | | | | |
| *Profitability* | | Net income ($/crop/ha/season) | | | | Net income (Total net income for all farm activities) | | | Participatory Evaluation | | |
| Environmental | | | | | | | | | | | |
| *Fuel availability* | | Fuel biomass (residuals)/plot | | | | Fuel biomass (residuals)/farm | | | Biomass measurement | | |
| *Water availability* | | % of plants wilting | | | | % of fields wilting | | | Field tests | | |
| *Soil biology* | | Total carbon (%) | | | |  | | | Simulated data | | |
|  | | | | | | | | | | | | |
| 6. Deliverables | | | | | | | | Means of verification | | | | Delivery date |
| 6.1 Long term implications of intercropping systems on climate, market risks and resource use efficiency of smallholder farms assessed | | | | | | | | Project progress Reports and a publication in peer-reviewed journal | | | | Jul. 2020 |
|  | | | | | | | | | | | | |
| 7. How will scaling be achieved? | | | | | | | | | | | | |
| The main beneficiary of this sub-activity isthe scientific community who will through publications, gain better insights into appropriate intervention strategies that increase resource use efficiencies, productivity and profitability while reducing production risk. | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 8. How are the activities in this protocol linked to those of others? | | | | | | | | | | | | |
| The modelling outputs will inform better intervention strategies for doubled-up legumes, cereal-legume intercrops implemented by ICRAF, Hombolo and SUA (integrated soil fertility management) and Malawi. We will also work with the Systems agronomist (IITA) and the Michigan State University team of Malawi by linking with Sub-activity: 1.1.1.2. The data collected from the Moshi-Maile site will be shared with the Systems Agronomist for IITA. | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 9. Gantt chart | | | | | | | | | | | | |
|  | **Activity** | | | Begin | | | | -End | | Workdays- | |
| 1. | Soil sample collection | | | Tue 12/03/19 | | | | Mon 3/30/20 | | 85 | |
| 2. | Data collection and analysis | | | Wed 1/01/20 | | | | Fri 7/31/20 | | 153 | |
| 3. | Field monitoring | | | Fri 1/03/20 | | | | Thu 4/30/20 | | 85 | |
| 4. | Laboratory analysis | | | Mon 12/02/19 | | | | Fri 7/31/20 | | 175 | |
| 5. | Report and write up | | | Mon 8/03/20 | | | | Tue 9/15/20 | | 32 | |

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| Outcome 5: Partnerships for the scaling of sustainable intensification research products and innovations operationalized | | | | | | | | | | | |
| a. Output 5.1 | | | Opportunities for the use and adoption of sustainable intensification technologies identified for relevant farm typologies | | | | | | | | |
| b. Activity 5.1.2 | | | Use farm trial data to apply crop simulation models (APSIM) and assess performance over space and time, including assessment of climate-smart technologies to establish the potential for adaptation and mitigation | | | | | | | | |
| c. Sub-activity 5.1.2.2 | | | Evaluate the potential contributions of integrated management around the five SIAF domains with emphasis on Africa RISING interventions in Tanzania | | | | | | | | |
|  | | | | | | | | | | | |
| d. Research team | | | | | | | | | | | |
| Name | | | | Institution | | Role | | | | | |
| Job Kihara | | | | CIAT | | PI  Lead ISFM team members to select what data are to be collected during this 2019/20 that contribute to the ISFM evaluation  Lead the team to collate and analyze the data  Lead writing a draft manuscript on contributions of ISFM around the domains | | | | | |
| Mateete Bekunda | | | | IITA | | Ensure that activities to collect ISFM related data are included in the partners’’ workplans | | | | | |
| Julius Manda | | | | IITA | | Whole farm productivity and economics with and without ISFM (3 farms like Mailes’ case). This will feed into whole farmer Nutritional data prepared by SUA | | | | | |
| Yasinta Muzanila | | | | SUA | | Whole-farm nutritional aspects relating to role of ISFM e.g. from Mailes’ farm including relating productivity and referring to lookup-tables | | | | | |
| Mawazo Shitindi | | | | SUA | | N-fixation data from Pigeon pea for Kongwa-Kiteto (either measured or estimated from productivity data and assumed %NDFA for drylands).  Wind and water erosion based on with and without structures | | | | | |
| Leonard Marwa and Inviolate Dominick | | | | TALIRI and WorldVeg | | Poultry manure production and effects on veg production (can also be a desktop study) | | | | | |
| Christopher. Mutungi, Julius Manda | | | | IITA | | Access to nutritional foods for farmers who are practicing ISFM (vs those not). Will include information related to effects of crop combinations/varieties and other management practices (both from planned surveys) | | | | | |
| Anthony Kimaro, Elirehema. Swai, Patrick Okori | | | | ICRAF, TARI Hombolo, ICRISAT | | Resilience arising from ISFM technologies e.g. tied ridges and improved varieties. Information includes performance versus the control under variable weather. Data is derived from fields such as Maile’s farm (tied ridges had good legume yields while neighboring farmers had almost none in last season) and ICRISAT’s trial which also are using ridges | | | | | |
| Gundula Fischer | | | | IITA | | Whole farm data for social domain (three cases): description of soil fertility management and perceptions of outcomes; quantitative data from SWC survey in K/K (fertilizer use with fanya juu and tied ridges and perceived changes) | | | | | |
|  | | | | | | | | | | | |
| e. Students: Nil | | | | | | | | | | | |
|  | | | | | | | | | | | |
| f. Location(s): | | Babati and Kongwa-Kiteto sites | | | | | | | | | |
|  | | | | | | | | | | | |
| g. Start date | | November 2019 | | | | | | | | | |
|  | | | | | | | | | | | |
| h. End date | | June 2021 | | | | | | | | | |
|  | | | | | | | | | | | |
| 1. Justification | | | | | | | | | | | |
| Africa RISING has been testing various ISFM-based practices in its intervention sites. Although individual teams have analyzed specific effects of the practices, there are gaps especially around the social and human domains of the SIAF. Besides, there is no system-wide assessment that can inform performance overall as well as under different contexts, e.g. agro-ecological zones. Another element is the over-emphasis so far on plot-level indicators with little or no focus on the community and landscape-level impacts. This activity tries to address some elements of these while also bringing out key considerations necessary for future evaluations of ISFM impacts. | | | | | | | | | | | |
|  | | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | | |
| 2.1 To assess system-wide effects of integrated soil fertility management on indicators within the five domains of SIAF in Tanzania | | | | | | | | | | | |
|  | | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | | |
| 3.1 How does ISFM influence indicators of the productivity, economic, environment, social and human domains? | | | | | | | | | | | |
|  | | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | | |
| Experiment design, implementation and data analysis:  This is a system-wide analysis pulling data from several sources. We will analyze existing Africa RISING data from teams (mostly productivity and economics and combing through for the others) and integrate with new data being collected in surveys (by Christopher and Julius). We will as well review success stories published under Africa RISING that could inform on some aspects of the impacts of ISFM. Our approach includes a review of the literature published on the effects of ISFM mostly on less understood domains to relate our assessment with what could be existing in the literature. | | | | | | | | | | | |
|  | | | | | | | | | | | |
| 5. Data (with metrics) to be collected and uploaded on Dataverse | | | | | | | | | | | |
| Domain & *Indicator* | Field/plot level metrics | | | | Farm level metrics | | Household level metrics | | Community/landscape metrics | | Measurement method |
| Productivity | | | | | | | | | | | |
| *Crop productivity* | Maize, beans, pigeon pea productivity (kg/ha/season). ALL teams | | | | Maize, beans, pigeon pea productivity (Kg/ha/season). Multiple teams (Julius, Christopher) | |  | | Maize, beans, pigeon pea productivity (Kg/ha/season) Francis | | Yield measurements and  Household survey |
| *Variability of production* |  | | | |  | | Rating of production risk (case-studies)  Gundula | | Variability of NPP  Francis | | Farmer evaluation and Remote sensing |
| *Biomass productivity* | Maize, beans, pigeon pea and cowpea biomass productivity (kg/ha/season) | | | | Maize, beans, pigeon pea and cowpea biomass productivity (kg/ha/season)  Multiple teams | |  | | Maize, beans, pigeon pea and cowpea biomass productivity (kg/ha/season) Francis (for Malawi) | | Yield measurements,  Household surveys and Remote sensing |
| Residue production (kg/ha/season) | | | | Residue production (kg/ha/season) Kimaro | |  | | Residue production (kg/ha/season) Francis (for Malawi) | | Yield measurements |
| Rating of residue production | | | |  | |  | | Rating of residue production (case-studies) Gundula/UDOM | | Farmer evaluation |
| Economic | | | | | | | | | | | |
| *profitability and labor requirements* | Gross margins ($/crop/ha/ season): all teams | | | | Gross margins ($/crop/ha/ season): Julius Manda | | Net income (total net income for all farm activities) Julius Manda | |  | | Survey |
| *Labor requirement* | Labor requirement (hours/ha) (Julius Manda) | | | |  | | Farmer rating of labor (Julius Manda) | |  | | Household survey |
| *Variability of profitability* | ALL teams | | | | Julius Manda (from surveys) | | Probability of low profitability: Julius Manda | |  | | Household survey |
| *Market participation* |  | | | |  | | Market participation: % of maize sold to the market: Julius Manda | |  | | Household survey |
| Environment | | | | | | | | | | | |
| *Fuel availability, soil* | Fuel biomass (kg/ha/season)  --Kihara, Kimaro and Okori | | | | Fuel biomass (kg/ha/season)  -- Kimaro (e.g. Maile’s whole farm) | |  | |  | | Participatory exercise |
| *Soil physical quality* | Erosion: Shitindi  N-Fixation: Kihara, Shitindi | | | |  | |  | |  | | Soil tests |
| *Vegetative cover* |  | | | |  | |  | | % vegetative cover by type  % Bare land  -Francis | | Remote sensing |
| Human condition | | | | | | | | | | | |
| *Nutrition* | Protein production (g/ha)—all teams | | | | Protein production (g/ha)—Prof Muzanila | | Protein production (g/ha) —Prof Muzanila | |  | | Lookup tables and production data from surveys |
| *Food security* | Food production (Calories/ha/year) –all teams | | | | Months of food insecurity; Rating of food security—Prof Muzanila | | Months of food insecurity; Rating of food security—Prof Muzanila | |  | | Field measurement/ lookup tables |
| Social | | | | | | | | | | | |
| *Gender equity* |  | | | |  | | Income by gender –Christopher, Gundula | |  | | Key informant interviews |
| Rating of technologies by gender –Gundula | | | |  | | Rating of technologies by gender --Gundula | |  | | Key informant interviews |
| Food security by gender (NB These are qualitative evaluations so no metrics): Gundula | | | |  | | Food security by gender (NB These are qualitative evaluations so no metrics) Gundula | |  | | Key informant interviews |
| *Equity (generally)* |  | | | |  | | Rating of technologies by group: Gundula | |  | | Focus group discussions (for farmers hosting trials) |
| Household level for with and without ISFM will be based on a categorization of households in the surveys undertaken. And households could be at different levels of ISFM use. Community level can be an extrapolation of households to all the households within the community/landscape. | | | | | | | | | | | |
|  | | | | | | | | | | | |
| 6. Deliverables | | | | | | | | Means of verification | | Delivery date | |
| 6.1 List of key data to be collected by research teams | | | | | | | | Research reports | | Dec. 2019 | |
| 6.2 Draft ISFM publication including the five domains | | | | | | | | Research reports | | Sep. 2020 | |
|  | | | | | | | | | | | |
| 7. How will scaling be achieved? | | | | | | | | | | | |
| Africa RISING teams involved in this activity will be exposed to the data formatting and analyses conducted. This is a co-learning and cross-hybridization of knowledge. Perhaps they can use it in their own work. | | | | | | | | | | | |
|  | | | | | | | | | | | |
| 8. How are the activities in this protocol linked to those of others? | | | | | | | | | | | |
| This activity is drawing information and data from all the planned activities for Africa RISING in Babati. Refer to the systems research teams and their defined roles above. | | | | | | | | | | | |

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| Outcome 5: Partnerships for the scaling of sustainable intensification research products and innovations operationalized | | | | | | | | | | |
| a. Output 5.1 | | | Opportunities for the use and adoption of sustainable intensification technologies identified for relevant farm typologies | | | | | | | |
| b. Activity 5.1.3 | | | Establish adaptive field experiments with mineral and crop/animal-derived organic manure | | | | | | | |
| c. Sub-activity 5.1.3.1 | | | Rainfall-responsive nitrogen fertilization strategies: in search of increased nitrogen use efficiency by smallholder farmers under rain-fed conditions | | | | | | | |
|  | | | | | | | | | | |
| d. Research team | | | | | | | | | | |
| Name | | | Institution | | Role | | | | | |
| Regis Chikowo, Sieg Snapp | | | MSU | | PIs, research conceptualization ad implementation | | | | | |
| Julius Manda | | | IITA | | Guide on economic analysis approaches e.g. providing templates | | | | | |
| N.N. | | | IITA/IFPRI | | M&E support | | | | | |
|  | | | | | | | | | | |
| e. Students: Nil | | | | | | | | | | |
|  | | | | | | | | | | |
| f. Location(s) | Linthipe, Mtubwi, Nsanama, Nyambi, Extension Planning Areas (EPAs) | | | | | | | | | |
|  | | | | | | | | | | |
| g. Start date | October 2017 | | | | | | | | | |
|  | | | | | | | | | | |
| h. End date | September 2021 | | | | | | | | | |
|  | | | | | | | | | | |
| 1. Justification | | | | | | | | | | |
| Agricultural intensification invariably requires the efficient use of resources. This is especially so for resource-constrained farmers in developing countries. While it is known that nitrogen (N) fertilizers recovery by crops is intricately linked to soil water availability, current N application strategies, especially when urea-N is used, barely reflect the necessity for reduced N application when rainfalls fail or more N application when the season is favorable. For farmers who invest in N fertilizers, the high risk for financial losses associated with drought-induced crop failure is often beyond the threshold that these farmers can absorb. Thus, financial risk reduction must be at the core in formulating innovations around N fertilizer use by smallholder farmers. To date, we have already shown that rainfall-responsive N fertilization helps farmers to avoid unwarranted investments in N fertilizer, especially in drought conditions.  In this study, we thus build on the existing knowledge from other studies on fertilization strategies that enhance efficiency. We have implemented this study over the past two seasons, which were very different. As season type is a random variable, it is important to test how this approach could be applied in a range of rainfall season types. We expect this initiative to contribute to redesigned innovations around fertilizer technologies. | | | | | | | | | | |
|  | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | |
| 2.1 To determine the effect of rainfall-responsive application of side-dressing N fertilizer to nitrogen use efficiency across a rainfall gradient | | | | | | | | | | |
| 2.2 To determine the effect of soil type in the application of the rainfall-responsive N fertilization strategy | | | | | | | | | | |
| 2.3 To determine the economic benefits associated with strategic N application rates | | | | | | | | | | |
|  | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | |
| 3.1 How does nitrogen use efficiency respond to fertilizer application tailored to rainfall gradient? | | | | | | | | | | |
|  | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | |
| Experiment design, implementation and data analysis:  This experiment was initiated during the 2017/2018 cropping season in Machinga district Ntubwi, Nsanama, Nyambi) and a new site was initiated in Linthipe EPA during 2018/2019 cropping season. Treatments for this experiment that are replicated three times per site are shown in Table 1 in protocol H. Nutrient deficiencies, especially P, are known to limit the uptake of N by crops. Therefore, P limitations are reduced across all treatments through a blanket application of 10 kg ha-1 P as single super phosphate or NPK compound fertilizer. Treatments 2-9 receive 23 kg ha-1 N at planting as ammonium nitrate. Additionally, treatments 3-9 receive one or two side dressings of 23 kg ha-1 N, designated as low rate [L] or high rate [H] at 46 kg ha-1 N as ammonium nitrate. For example, Treatment 5 [92N-LH) has a total of 92 kg N ha-1, in the form of 23 kg N at planting plus two further applications of 23 kg and 46 kg at 4 and 6 WAE, respectively. The order of application of L and H side-dressing N rates application is important, as this differentiates Treatments 5 and 7. Treatment 8 is like Treatment 4, with the 5 kg zinc applied as basal zinc sulphate as the sole difference. Treatment 9 is the non-fixed side-dressing N application strategy – less N is applied when rainfall is below normal, or more is applied to a maximum of 138 kg/ha. Withholding N application during a drought season or more N applied in a season with good rainfall is expected to increase farm profits or reduce losses. The magnitude of these economic benefits will be assessed. | | | | | | | | | | |
|  | | | | | | | | | | |
| 5. Data (with metrics) to be collected and uploaded on Dataverse | | | | | | | | | | |
| SI Domains & *Indicator* | | Field/Plot level metrics | | Farm level metrics | | Household level metrics | Community /landscape metrics | Measurement method | |
| Productivity | | | | | | | | | |
| *Maize grain productivity* | | Maize grain and biomass yield (kg/ha/season) | | Maize production (kg/ha | |  |  | Yield measurements | |
| *Maize biomass productivity* | | Legume grain and biomass yield (kg/ha/season) | | Maize residue production (kg/ha/season) | |  |  | Yield measurements | |
| *Yield gap* | | Yield gap for maize, soybean, groundnuts (kg/ha/season) | |  | |  |  | Yield measurements | |
| Economic | | | | | | | | | |
| *Profitability* | | Net income ($/crop/ha/season) | |  | |  |  | Survey | |
| *Labor requirement* | |  | | Farmer rating of labor | | rating of technologies by gender |  | Farmer evaluation | |
| Environmental | | | | | | | | | |
| *Water availability* | | Soil moisture | |  | |  |  | Field tests | |
| *Water availability* | | % plants wilting | |  | |  |  | Participatory exercise | |
| Human condition | | | | | | | | | |
| *Food security* | | Food production (calories/ha/year) | |  | | Months of food insecurity |  | Survey | |
| Social | | | | | | | | | |
| *Gender equity* | |  | |  | | Access to information |  | Focus group discussions | |
| *Social Cohesion* | |  | |  | | Level and reliability of social support | Participation in social groups | Household survey | |
|  | | | | | | | | | | |
| 6. Deliverables | | | | | | Means of verification | | | Delivery date | |
| 6.1 Field experiments established | | | | | | Field plans, protocols | | | Jan. 2020 | |
| 6.2 Soil moisture probes installed on at least 2 sites | | | | | | Probes physically in field, data downloaded every month | | | Jan. 2020 | |
| 6.3 Field days held with partners and DAECC disseminates promising results | | | | | | Field day reports | | | May 2020 | |
| 6.4 Soil water and nutrients use interactions assessed | | | | | | Draft publication | | | Sep. 2020 | |
|  | | | | | | | | | | |
| 7. How will scaling be achieved? | | | | | | | | | | |
| This technology will be scaled countrywide through an existing Airtel 321 agriculture information service (pilot service), therefore once efficacy proved, the next step would be to engage Airtel, as well as the national Extension Services of the Ministry of Agriculture to reach at least 100,000 farmers. | | | | | | | | | | |
|  | | | | | | | | | | |
| 8. How are the activities in this protocol linked to those of others? | | | | | | | | | | |
| This is a novel system not yet widely used. We are piloting the technology. However, all other protocols are using the same principle on increasing resource-use efficiencies. | | | | | | | | | | |
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9. Gantt chart

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|  | **2019** | | | **2020** | | | | | | |
| **Activity** | **Oct-** | **Nov** | **Dec** | **Jan** | **Feb-Mar** | **Apr** | **May** | **Jun-Jul** | **Aug** | **Sep** |
| Procurement of inputs |  |  |  |  |  |  |  |  |  |  |
| IITA –MSU contract/inputs distribution |  |  |  |  |  |  |  |  |  |  |
| MSU/partners contracting |  |  |  |  |  |  |  |  |  |  |
| MSc students engaged/ |  |  |  |  |  |  |  |  |  |  |
| Land preparation/goats’ acquisition |
| Pre-establishment country meeting to ensure systems harmonization (about 22 Nov) |  |  |  |  |  |  |  |  |  |  |
| Establishment of action research/soil sampling. |  |  |  |  |  |  |  |  |  |  |
| Field assessments/data collection (crop/livestock) |  |  |  |  |  |  |  |  |  |  |
| Farmer/farms profiling for case studies |  |  |  |  |  |  |  |  |  |  |
| Yield data collection on cases study farms/harvesting |  |  |  |  |  |  |  |  |  |  |
| Fields days (vegetative stage/maturity stage) |  |  |  |  |  |  |  |  |  |  |
| Host project external evaluation team/field tour |  |  |  |  |  |  |  |  |  |  |
| Yield cuts survey/general harvesting of trials |  |  |  |  |  |  |  |  |  |  |
| Post-harvest workshops /feedback meetings |  |  |  |  |  |  |  |  |  |  |
| Pre-report & planning country meeting (about 20 July 2020) |  |  |  |  |  |  |  |  |  |  |
| Report writing/publications |  |  |  |  |  |  |  |  |  |  |
| Dataverse data upload |  |  |  |  |  |  |  |  |  |  |

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| Outcome 5: Partnerships for the scaling of sustainable intensification research products and innovations operationalized | | | | | | | | | | | | | | | | |
| a. Output 5.1 | | | | | Opportunities for the use and adoption of sustainable intensification technologies identified for relevant farm typologies | | | | | | | | | | | |
| b. Activity 5.1.3 | | | | | Establish adaptive field experiments with mineral and crop/animal-derived organic manure | | | | | | | | | | | |
| c. Sub-activity 5.1.3.2 | | | | | Assessing the effect of residue quantity and quality, and water conservation on maize productivity and nitrogen dynamics on smallholder farms in Malawi | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| d. Research team | | | | | | | | | | | | | | | | |
| Name | | | | | | | Institution | | Role | | | | | | | |
| Regis Chikowo, Sieg Snapp | | | | | | | MSU | | PIs, research conceptualization ad implementation | | | | | | | |
| Julius Manda | | | | | | | IITA | | Carry out economic analysis, train research team on appropriate methodologies | | | | | | | |
| N.N. | | | | | | | IITA/IFPRI | | M&E | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| e. Students | | | | | | | | | | | | | | | | |
| Name | | | | | | Institute | | | | | Degree | | Start | | | End |
| Chiwimbo Gwenambira | | | | | | MSU | | | | | PhD | | 2016 | | | 2020 |
|  | | | | | |  | | | | |  | |  | | |  |
| f. Locations | | Lithipe, Kandeu, Mtubwi, Nsanama, Nyambi, Extension Planning Areas (EPAs) | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| g. Start date | | | October 2016 | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| h. End date | | | September 2021 | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 1. Justification | | | | | | | | | | | | | | | | |
| Many soils on smallholder farms in Malawi have poor soil organic matter content. This results in poor maize productivity when insufficient mineral fertilizers are added. Building soil organic matter requires improving both cereal and legume crops primary productivity through mineral fertilizers and retaining the associated crop residues on the cropped lands. These residues decompose to provide mineral N to crops grown in sequence, as well as being an important source for SOM capitalization. Residues of legumes crops have a narrow C/N ration and are hypothesized to improve N cycling and benefit the rotational crop, whereas residues of maize, which have a wide C/N ratio, promote immobilization. During the past 3 years, we documented the challenges is managing crop residues on the farms. The tradeoffs are rarely used in informed decision making and indicate that high-quality residues must be preserved for soil fertility gains instead of the easy pathway of land preparation through burning the residues is often overlooked.  While the knowledge on N dynamics following incorporation of different residue quality is fairly documented, what is not clear is the interaction between crop residue quality, quantity and soil water management on maize productivity. | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | | | | | | | |
| 2.1 Does incorporating soil water enhancing technologies increase/reduce the immobilization potential of maize residues? | | | | | | | | | | | | | | | | |
| 2.2 What is the effect of varying the quantity of the crop residues incorporated (both maize and legumes) on mineral N dynamics, soil water content and maize productivity? | | | | | | | | | | | | | | | | |
| 2.3 For farmers with limited fertilizer use (50% NP), how detrimental is the use of maize residues (X0, X1, X2), with or without water conservation measures? | | | | | | | | | | | | | | | | |
| 2.4 What is the fertilizer substitution value of different quantity residues generated from a groundnut/pigeon pea doubled-up system? | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 3. Research questions: see objectives | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | | | | | | | |
| Experiment design, implementation and data analysis:  Treatments for this experiment are shown in Table 1 (in Protocol H) and replicated three times per site. The experiment was implemented during 2016/2017 (Year 1) and 2017/2018 (Year 2) cropping seasons in Machinga and Mangochi districts at four sites. The residue generation phase will be repeated during 2018/19 cropping season, and the effects tested during the 2019/2020 cropping season in Linthipe, Ntubwi, Nsanama, Nyambi and Ntiya EPAs. | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 5. Data (with metrics) to be collected and uploaded on Dataverse | | | | | | | | | | | | | | | | |
| Domain & *Indicator* | | | Field/plot level metrics | | | | Farm level metrics | | | | Household level metrics | | Measurement method | | |
| Productivity | | | | | | | | | | | | | | | |
| *Maize grain productivity* | | | Maize grain and biomass yield (kg/ha/season) | | | | Maize production (kg/ha | | | |  | | Yield measurements | | |
| *Maize biomass productivity* | | | Legume grain and biomass yield (kg/ha/season | | | | Maize residue production (kg/ha/season) | | | |  | | Yield measurements | | |
| *Legume productivity* | | | Soybean/groundnut grain and biomass yield (kg/ha/season) | | | |  | | | |  | | Yield measurements | | |
| *Yield gap* | | | Yield gap for maize, soybean, groundnuts (kg/ha/season) | | | |  | | | |  | | Yield measurements | | |
| Economic | | | | | | | | | | | | | | | |
| *Profitability* | | | Net income ($/crop/ha/season),  Gross margin | | | |  | | | |  | | Survey | | |
| Environmental | | | | | | | | | | | | | | | |
| *Soil biology* | | | Soil organic carbon (g/kg) | | | |  | | | |  | | Laboratory tests | | |
| *Soil chemical quality* | | | Biological N2-fixation(kg/ha) | | | | Biological N2-fixation(kg/farm) | | | |  | | Direct measurement | | |
| Human condition | | | | | | | | | | | | | | | |
| *Nutrition* | | | Protein production (g/ha) | | | |  | | | |  | | Lookup tables | | |
| *Food security* | | | Food production  (calories/ha/year) | | | |  | | | | Months of food insecurity | | Survey | | |
| Social | | | | | | | | | | | | | | | |
| *Social cohesion* | | |  | | | |  | | | | Participation in community activities | | Focus group discussions | | |
| *Gender equity* | | | Rating of technologies by gender | | | |  | | | |  | | Participatory evaluation | | |
|  | | | | | | | | | | | | | | | | |
| 6. Deliverables | | | | | | | | | | Means of verification | | | | | Delivery date | |
| 6.1 At least one field trial established in each of the 5 EPA study sites | | | | | | | | | | Protocol, field plans available | | | | | Jan. 2020 | |
| 6.2 Field days held with partners | | | | | | | | | | Field day reports | | | | | May 2020 | |
| Residue and nitrogen interactions assessed | | | | | | | | | | Technical report | | | | | Sep. 2020 | |
| 6.3 We target at least 14,000 (10% of households in 7 EPAs where we have action research sites) to reduce the practice of crop residue burning. | | | | | | | | | | Local experts/key informant reports | | | | | Sep. 2020 | |
|  | | | | | | | | | | | | | | | | |
| 7. How will scaling be achieved? | | | | | | | | | | | | | | | | |
| This technology will be scaled countrywide through the National Extension Services of the Ministry of Agriculture. Already there are concerns of too many wildfires that get out of control that originate when farmers burn crop residues as part of land preparation. Evidence from this work is vital to reinforce the need to keep crop residues in the fields as part of extension messages. We will work with the extension system to incorporate this message in the mainstream extension communication. Total Land Care and other NGOs; One Acre Fund interested in residue utilization. EG.3.2-24 (Number of individuals in the agriculture system who have applied improved management practices or technologies with United States Government – USG- assistance). | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 8. How are the activities in this protocol linked to those of others? | | | | | | | | | | | | | | | | |
| * CIMMYT uses mulching as one of the three pillars of conservation agriculture. CIMMYT experiments with conservation agriculture and crop residues being implemented in Machinga district. * CIMMYT Case Studies Protocol on farm-scale analysis of SI technologies directly investigates the use of crop residues in combination with minimum tillage on farms. | | | | | | | | | | | | | | | | |
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9. Gantt chart

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **2019** | | | **2020** | | | | | | |
| **Activity** | **Oct** | **Nov** | **Dec** | **Jan** | **Feb-Mar** | **Apr** | **May** | **Jun-Jul** | **Aug** | **Sep** |
| Procurement of inputs |  |  |  |  |  |  |  |  |  |  |
| IITA –MSU contract/inputs distribution |  |  |  |  |  |  |  |  |  |  |
| MSU/partners contracting |  |  |  |  |  |  |  |  |  |  |
| MSc students engaged/ |  |  |  |  |  |  |  |  |  |  |
| Land preparation/goats acquisition |
| Pre-establishment country meeting to ensure systems harmonization (about 22 Nov) |  |  |  |  |  |  |  |  |  |  |
| Establishment of action research/soil sampling. |  |  |  |  |  |  |  |  |  |  |
| Field assessments/data collection (crop/livestock) |  |  |  |  |  |  |  |  |  |  |
| Farmer/farms profiling for case studies |  |  |  |  |  |  |  |  |  |  |
| Yield data collection on cases study farms/harvesting |  |  |  |  |  |  |  |  |  |  |
| Fields days (vegetative stage/maturity stage) |  |  |  |  |  |  |  |  |  |  |
| Host project external evaluation team/field tour |  |  |  |  |  |  |  |  |  |  |
| Yield cuts survey/general harvesting of trials |  |  |  |  |  |  |  |  |  |  |
| Post-harvest workshops /feedback meetings |  |  |  |  |  |  |  |  |  |  |
| Pre-report & planning country meeting (about 20 July 2020) |  |  |  |  |  |  |  |  |  |  |
| Report writing/publications |  |  |  |  |  |  |  |  |  |  |
| Dataverse data upload |  |  |  |  |  |  |  |  |  |  |

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| Outcome 5: Partnerships for the scaling of sustainable intensification research products and innovations operationalized | | | | | | | | | | | | | | | | |
| a. Output 5.1 | | | | | | Opportunities for the use and adoption of sustainable intensification technologies identified for relevant farm typologies | | | | | | | | | | |
| b. Activity 5.1.3 | | | | | | Establish adaptive field experiments with mineral and crop/animal-derived organic manure | | | | | | | | | | |
| c. Sub-activity 5.1.3.3 | | | | | | Assessing the integrative effect of in situ rainwater harvesting and fertilizer micro-dosing on crop yield, water and nutrient use efficiency in Kongwa District | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| d. Research team | | | | | | | | | | | | | | | | |
| Name | | | | Institution | | | | Role | | | | | | | | |
| Mawazo Shitindi | | | | SUA | | | | PI designing the research, supervising graduate student (research assistant) and overseeing the project activities) | | | | | | | | |
| Anthony Kimaro | | | | ICRAF | | | | Co-researcher to provide technical support on maize legume intercrops and secondary data on fertilizer micro-dosing and crop productivity. | | | | | | | | |
| ElirehemaSwai | | | | TARI Hombolo | | | | Co-researcher to provide technical support on designing and managing rainwater harvesting infrastructures. | | | | | | | | |
| Julius Manda | | | | IITA | | | | Backstopping on economics of integrating rainwater harvesting with fertilizer micro-dosing in maize-legume cropping systems of Kongwa and Kiteto. | | | | | | | | |
| Gundula Fischer | | | | IITA | | | | Technical support on assessing social economics of integrating rainwater harvesting and fertilizer micro-dosing and perception of the technology, labor requirement and returns on labor investment | | | | | | | | |
| Christopher Mutungi | | | | IITA | | | | Assessing nutritional value and food safety properties of maize, pigeon peas and groundnuts produced from the research work using resources from IITA | | | | | | | | |
| Anthony Kimaro | | | | ICRAF | | | | Technical backstopping and providing historical maize and legume productivity and resilience data from Gliricidia-based cropping systems | | | | | | | | |
| IFPRI | | | | IFPRI | | | | To provide support in monitoring of the research activities to ensure compliance with the FtF monitoring system including periodically assisting in data collection (both FtF and Custom indicators data) with critical gender perspective and uploading into the FfF system | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| e. Student | | | | | | | | | | | | | | | | |
| Name | | | | | Institute | | | | Degree | | | | Start | | | End |
| Mushi Revocatus | | | | | SUA | | | | MSc. Soil Science and Land Management | | | | Jan. 2019 | | | Nov. 2021 |
|  | | | | | | | | | | | | | | | | |
| f. Locations | | | Mlali village of Kongwa district and Njoro village of Kiteto district | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| g. Start date | | | December 2018 and building on what has been done by TARI Hombolo and ICRAF since 2014 | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| h. End date | | | November 2021 | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 1. Justification | | | | | | | | | | | | | | | | |
| (This activity formed part of the research plan 2018-2019. It has been carried forward since not all trials and analyses had been finished)  Efficient use of every raindrop and nutrient applied in the form of fertilizer is, therefore, a prerequisite for food and income security of the population inhabiting semiarid lands. Improving water and nutrient use efficiency of cropping systems thus constitute key strategies for mitigating the negative impact of climate change on food and income security in semiarid lands. In-situ rainwater harvesting, and fertilizer micro-dosing technologies have been evaluated in Kongwa and Kiteto since 2017. Tied ridges and contours have been introduced and evaluated for soil erosion control in demonstration plots with farmers in Kongwa. Different fertilizer application rates have also been tested with farmers in Kongwa and Kiteto using two maize varieties and two fertilizer types and optimal N and P rates have been generated. The integrative effect of in-situ rainwater harvesting and fertilizer micro-dosing on crop productivity was not addressed. | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | | | | | | | |
| 2.1 To evaluate the integrated effect of in-situ rainwater harvesting (tied ridges) and fertilizer micro-dosing technologies on overall crop productivity, and water and nutrient use efficiency of maize, pigeon peas and maize-groundnut cropping systems | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | | | | | | | |
| 3.1 To what extent does integration of in situ rainwater harvesting and fertilizer micro-dosing on crop yield, and water and nutrient use efficiency? | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | | | | | | | |
| Experiment design, implementation and data analysis:  A split-split plot field experiment laid in a randomized complete block design will be implemented. Maize sole crop, maize-pigeon pea and maize-groundnut intercrops will be evaluated under two different water management systems (+/- tied ridges) with fertilizer rates of 0, ¼, and ½ and full maize recommended fertilizer rate in the area | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 5. Data (with metrics) to be collected and uploaded on Dataverse | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| Domain & *Indicator* | Field/plot level metrics | | | | | Farm level metrics | | | Household level metrics | | Community/landscape metrics | | | Measurement method | |
| Productivity | | | | | | | | | | | | | | | |
| *Crop productivity* | *Maize, pigeon peas and ground nut grain and stover or wood yield (t/ha); nutrient use efficiency (kg/g of fertilizer/nutrient used); rainwater use efficiency (kg of grain and biomass/mm/year)* | | | | |  | | |  | |  | | |  | |
|
| Economic | | | | | | | | | | | | | | | |
| *Profitability* | Profitability of technology (gross margin in USD/ha); Cost-Benefit ratio (USD/USD) | | | | |  | | |  | |  | | |  | |
| Environment | | | | | | | | | | | | | | | |
| *Crop nutrients* | Crop nutrient uptake and nutrients exported out of the fields (kg/ha) | | | | |  | | |  | |  | | |  | |
| Human condition | | | | | | | | | | | | | | | |
| *Nutrition* | Nutritional value [protein and micronutrients (g/ha)] and food safety [aflatoxin analysis (µg/kg)] of the products to be done by IITA on produce samples collected during harvest | | | | |  | | |  | |  | | |  | |
| Social | | | | | | | | | | | | | | | |
| *Gender* | Feasibility and acceptability of the technology (numbers of farmers by gender and age groups) returns on labor investment (USD/person day); accessibility and use of fertilizers (kg/ha/individual farmer); number of farmers using fertilizers | | | | |  | | |  | |  | | |  | |
|  | | | | | | | | | | | | | | | | |
| 6. Deliverables: | | | | | | | | | | | Means of verification | | | Delivery date | | |
| 6.1 Research protocol and work plan developed | | | | | | | | | | | Submission of research protocol and work plan | | | Dec. 2018 | | |
| 6.2 Farmers mobilized, experimental sites identified, and field experiments conducted | | | | | | | | | | | Number of experiments conducted, and farmers involved in the research | | | 31 Aug. 2019 | | |
| 6.3 The feasibility of integrating in-situ rainwater harvesting and fertilizer micro-dosing technologies | | | | | | | | | | | Assessment report | | | 31 Aug. 2020 | | |
| 6.4 Data sets for the first year (2018/2020) uploaded | | | | | | | | | | | Uploaded data set | | | 31 Aug. 2020 | | |
| 6.5 At least two farmer field days and one research partner meeting conducted each year | | | | | | | | | | | Farmers' field day and meeting reports | | | 31 May 2020 | | |
| 6.6 Research results for year 1 presented at the annual project meeting and scientific conferences | | | | | | | | | | | Presentations made | | | Sep. 2019 | | |
|  | | | | | | | | | | | | | | | |
| 7. How will scaling be achieved? | | | | | | | | | | | | | | | |
| To scale this activity, development partners will be engaged to help in taking it to scale. | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 8. How are the activities in this protocol linked to those of others? | | | | | | | | | | | | | | | |
| Choice crop varieties for testing the proposed technology are validated with crop improvement (ICRISAT) and agronomic practices for the new varieties are validated with the S&WC (TARI Hombolo) and Fertilizer micro-dosing (ICRAF). | | | | | | | | | | | | | | | |

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| --- | --- | --- | --- | --- | --- | --- |
| Outcome 5: Partnerships for the scaling of sustainable intensification research products and innovations operationalized | | | | | | |
| a. Output 5.1 | | Opportunities for the use and adoption of sustainable intensification technologies identified for relevant farm typologies | | | | |
| b. Activity 5.1.4 | | Demonstrate the use and impact of crop residues, forages, and other organic resources as animal feed and nutrient resources | | | | |
| c. Sub-activity 5.1.4.1 | | Test the effect of feeding Napier grass and maize stover supplemented with bean haulms at different levels of milk yield under smallholder farmer conditions | | | | |
|  | | | | | | |
| d. Research team | | | | | | |
| Name | | Institution | | Role | | |
| Ben Lukuyu | | ILRI | | PI | | |
| Leonard Marwa | | ILRI | | Implementing livestock feeding trials | | |
| Data collection clerks | | To be recruited locally | | Farmer mobilization, full-time data collection and entry and backstop farmer trainings | | |
|  | | | | | | |
| e. Students: Nil | | | | | | |
|  | | | | | | |
| f. Locations: | Long, Sabilo and Seloto villages in Babati District | | | | | |
|  | | | | | | |
| g. Start date | Continuation of feed trials that started during 2014 | | | | | |
|  | | | | | | |
| h. End date | 2020 | | | | | |
|  | | | | | | |
| 1. Justification | | | | | | |
| In smallholder farming systems, the production of forage and fodder is often a sideline activity that is integrated with other areas of agricultural production. By growing and utilizing greater quantities of locally produced, high-quality forages, livestock production costs can be reduced without compromising the productivity, thus increasing on-farm sustainability. Introducing improved forages into small-scale mixed farming systems would reduce the competition for land because the same land is simultaneously used for both crop and forage production. Smallholder farmers in Babati District keep an average of 3-4 heads of cattle per household. These are mainly crossbreeding (Zebu crossed with exotic dairy cattle) and a few pure breeds, mainly Friesian cattle. A feed assessment (FEAST) survey conducted in 2015, identified the availability of adequate feeds in terms of quantity and quality as one of the factors constraining smallholder dairy production. Following that assessment, an impact study of introducing crop residues (maize stover, bean haulms and pigeon pea haulms) into basal rations on milk yield under smallholder farmer conditions was conducted. The current study adds value to the feeding situation by testing the use of improved Napier grass, fed in combination with the different types of crop residues in basal rations on milk yield under the same smallholder farmer conditions. | | | | | | |
|  | | | | | | |
| 2. Objectives | | | | | | |
| 2.1 Increase on-farm sustainability by growing and utilizing greater quantities of locally produced, high-quality forages. | | | | | | |
|  | | | | | | |
| 3. Research questions | | | | | | |
| What is the impact of feeding Napier grass and maize stover supplemented with bean haulms at different levels on milk yield under smallholder farmer conditions? | | | | | | |
|  | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | |
| Experiment design, implementation and data analysis:  The experiment design includes: 2 dairy cattle genotypes (local and improved cattle) x 2 basal rations (Napier grass vs Maize stover, each supplemented with bean haulms at different levels of 100, 80, 70, 60 % on dry matter basis.  The experiment will be a complete factorial design with farms representing experimental units and lactating cows within a farm being replicates. A total of 32 cows in early lactation will be selected from two villages. Early lactation allows us to monitor the increase in milk production and attribute it to feed. Initiate animal weight and stage of lactation data will be taken at the beginning f the trial and used to select and allocate animals to treatments. The experimental period will consist of a 7-day adjustment period and a 45-day data collection period. | | | | | | |
|  | | | | | | |
| 5. Data (with metrics) to be collected and uploaded on Dataverse | | | | | | |
| SI Domains | | | | | Responsible institution | |
| Productivity:  *Animal productivity*   * Milk (litres /animal /year) * Rating of animal productivity | | | | | ILRI and UDOM | |
| Economic:  *Profitability*   * Profitability (gross margin of diets expressed in $/treatment   *Labor requirement*   * Labor requirement (hours/day) * Farmer rating of labor | | | | | ILRI and UDOM | |
| Social:  *Gender equity*   * Time allocation by gender * Income by gender   *Equity*   * Rating of technologies by group | | | | | ILRI and UDOM | |
| Human Condition:  *Food security and nutrition*   * Milk production at farm level expressed as calories/cow/year and using available literature to derive protein output (g/cow) | | | | | ILRI | |
|  | | | | | | |
| 6. Deliverables | | | Means of verification | | | Delivery date |
| 6.1 Ethical approval | | | Ethical approval certificate | | | Aug. 2020 |
| 6.2 A total of 32 cows selected. Initiate animal weight and stage of lactation data taken at the beginning of the trial and used to select and allocate animals to treatments | | | Report on farms and experimental cows’ selection and allocation to treatments | | | Aug. 2020 |
| 6.3 At least 25 trial farmers, 4 Extension and 1 data collection clerk trained on cow management, feeding procedure and data collection during the experiment | | | Training report | | | Aug. 2020 |
| 6.4 Experimental diets evaluated by farmers | | | Evaluation report | | | Aug. 2020 |
| 6.5 Nutritive value of diets evaluated | | | Nutritive value data set | | | Aug. 2020 |
| 6.6 Feeding trials completed | | | Productivity data sets | | | Aug. 2019 |
| 6.7 Data analysis completed | | | Technical report | | | Sep. 2019 |
|  | | | | | | |
| 7. How will scaling be achieved? | | | | | | |
| Partnership with COSITA and World Vision to deliver training about technology to 500 farmers | | | | | | |
|  | | | | | | |
| 8. How are the activities in this protocol linked to those of others? N/A | | | | | | |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Outcome 5: Partnerships for the scaling of sustainable intensification research products and innovations operationalized | | | | | | | | | | | | | | | | |
| a. Output 5.1 | | | Opportunities for the use and adoption of sustainable intensification technologies identified for relevant farm typologies | | | | | | | | | | | | | |
| b. Activity 5.1.4 | | | Demonstrate the use and impact of crop residues, forages, and other organic resources as animal feed and nutrient resources | | | | | | | | | | | | | |
| c. Sub-Activity 5.1.4.2 | | | Demonstrate the effect of home-made feed rations based on Gliricidia sepium and vegetable waste on productivity of selected strains of chickens | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| d. Research team | | | | | | | | | | | | | | | | |
| Name | Institution | | | | | | | | Role | | | | | | | |
| Ben Lukuyu | ILRI | | | | | | | | PI | | | | | | | |
| Leonard Marwa | ILRI | | | | | | | | Research implementation | | | | | | | |
| Chrispinus Rubanza | UDOM | | | | | | | | Sourcing experimental chicks | | | | | | | |
| Mbesere | Extension staff – Babati district | | | | | | | | Farmer mobilization, training and backstop livestock feeding trials | | | | | | | |
|  | Extension staff – Kongwa, Kiteto districts | | | | | | | | Farmer mobilization, training and backstop livestock feeding trials | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| e. Students: Nil | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| f. Locations | Two villages (Babati district) and two villages (Kongwa, Kiteto districts) | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| g. Start date | 2014 (Building upon Phase I poultry nutrition studies) | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| h. End date | 2020 | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 1. Justification | | | | | | | | | | | | | | | | |
| A poultry nutrition Phase I study in Babati showed that feeding local chickens with home-made rations based on local feeds increased egg production by 26% and reduced mortality by 16%. This translated into an increased egg sales profit of 68% and live bird sales profit of 28%. In Africa RISING phase II, the livestock Babati team and working Kongwa/Kiteto team based at the University of Dodoma and ICRAF will be testing these technologies further in a more holistic manner. In Kongwa and Kiteto, another study was initiated to address breed improvement and use of Gliricidia leaf as a supplement in poultry feeding. These technologies will be integrated and implemented together in the current study; the synergies are expected from combining the breed selection with strengthening nutrition for improved performance of the rural chickens. | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | | | | | | | |
| To determine the effect of supplementing of *Gliricidia sepium* and vegetable leaf meal-based feed rations on production performance of selected improved chicken strains. | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | | | | | | | |
| 3.1 How does a G. sepium leaf meal-based ration affect performance of improved chicken strains? | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | | | | | | | |
| Experiment design, implementation and data analysis:  A complete randomized experimental design will be deployed to determine the effect of home-made rations on egg production, egg quality, growth rates and survival rates for one of the selected improved strains. Gliricidia and vegetable leaf meals will constitute 5, 10 or 15% of the rations as treatments. One farmer in each of the 4 villages will host one treatment and be supplied with 54 test chicks. | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 5. Data (with metrics) to be collected and uploaded on Dataverse | | | | | | | | | | | | | | | | |
| SI Domains | | | | | | | | | | | | | Responsible institution | | | |
| Productivity:  *Animal Productivity*   * Animal products (eggs/chicken /year) * Rating of animal productivity | | | | | | | | | | | | | ILRI, UDOM | | | |
| Economic:  *Profitability*   * Profitability (gross margin, based on egg production) | | | | | | | | | | | | | ILRI, UDOM | | | |
| Social:  *Gender equity*   * Rating of technologies by gender | | | | | | | | | | | | | ILRI, UDOM | | | |
| Human Condition:  *Food security and nutrition*   * Protein production (g/bird) | | | | | | | | | | | | | ILRI | | | |
|  | | | | | | | | | | | | | | | | |
| 6. Deliverables: | | | | | | | | Means of verification | | | | | | | Delivery date | |
| Ethical approval | | | | | | | | Ethical approval certificate (ILRI) | | | | | | | Aug. 2020 | |
| Experimental diets formulated and sampled | | | | | | | | Evaluation report | | | | | | | Aug. 2020 | |
| Feeding experiment set up | | | | | | | | Progress report (ILRI) | | | | | | | Aug. 2020 | |
| Nutritive value of diets evaluated | | | | | | | | Nutritive value data set (ILRI) | | | | | | | Aug. 2020 | |
| Experimental diets evaluated by farmers | | | | | | | | Farmer evaluation report (ILRI/UDOM) | | | | | | | Aug. 2020 | |
| Feeding trials completed | | | | | | | | Productivity data sets (ILRI/UDOM) | | | | | | | Aug. 2020 | |
| Complete data analysis | | | | | | | | Technical report to IITA(ILRI/UDOM) | | | | | | | Aug. 2020 | |
|  | | | | | | | | | | | | | | | | |
| 7. How will scaling be achieved? | | | | | | | | | | | | | | | | |
| Partnership with COSITA FIDE and World Vision estimated to reach about 1,000 farmers through the MWANGA platform | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 8. How are the activities this protocol linked to those of others? | | | | | | | | | | | | | | | | |
| This activity is linked to the vegetable research by World Vegetable Centre and the manure management research by ILRI. | | | | | | | | | | | | | | | | |
| Outcome 5: Partnerships for the scaling of sustainable intensification research products and innovations operationalized | | | | | | | | | | | | | | | | |
| a. Output 5.1 | | | | Opportunities for the use and adoption of sustainable intensification technologies identified for relevant farm typologies | | | | | | | | | | | | |
| b. Activity 5.1.6: | | | | Disseminate best-fit integrated crop-livestock technologies to reach and have effect on small-scale farmers in a landscape context | | | | | | | | | | | | |
| c. Sub-activity 5.1.6.1 | | | | Small-scale piloting of FarmMATCH – a framework for typology-based targeting and scaling of agricultural innovations. (Matching Agricultural Technologies to Farms and their Context | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| d. Research team | | | | | | | | | | | | | | | | |
| Name | | | | | | | Institution | | | | Role | | | | | |
| Jeroen Groot | | | | | | | WUR | | | | Farming systems analysis (Activity Leader) | | | | | |
| Francis Muthoni | | | | | | | IITA | | | | GIS specialist | | | | | |
| Beliyou Haile | | | | | | | IFPRI | | | | Economic analysis | | | | | |
| Lieven Claessens | | | | | | | IITA | | | | Farming systems analysis | | | | | |
| Carlo Azzarri | | | | | | | IFPRI | | | | Economic analysis | | | | | |
|  | | | | | | | | | | | | | | | | |
| e. Student | | | | | | | | | | | | | | | | |
| Name | | | Institute | | | | | | | Degree | | | Start | | | End |
| Vacancy | | | WUR | | | | | | | MSc | | | 1/9/19 | | | 1/3/20 |
|  | | | | | | | | | | | | | | | | |
| f. Locations | | Tanzania (Babati, Kongwa, Kiteto) and Malawi (Dedtza, Ntcheu) | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| g. Start | | 1/10/2019 | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| h. End | | 1/10/2020 | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 1. Justification | | | | | | | | | | | | | | | | |
| Increasingly, mobile phones and other ICT services are used to provide information and advice to farmers to facilitate learning, but support to targeting and scaling of agricultural technologies through ICT tools is scarce. ICT-based targeting and scaling approaches should not be considered a silver bullet, although they can increase the reach and reduce the costs of technology dissemination compared to traditional village extension services.  Sophisticated models of technology integration in farming activities exist, but they are often very data-intensive and do not extend beyond the farm level. Muthoni *et al.* (2017[[24]](#footnote-24)) utilized spatially gridded biophysical and socio-economic layers to generate what they called “sustainable recommendation domains” (SRDs) that could be targeted for scaling specific technologies. The effectiveness of the suitability assessment can be further refined as long as the features of individual farms are considered and directly related to technology characteristics during the targeting phase. Innovations in coupling knowledge among site characteristics, household features and technology attributes with the SRDs is needed to guide spatial targeting of suitable technologies.  The FarmMATCH approach explicitly tries to fill this knowledge gap, facilitating the matching between agricultural technologies to farms and their context. It contains 1) a learning and matching algorithm that identifies the most suitable and promising technologies for different farm types, and 2) a data mining and signaling algorithm that identifies hotspots of the suitability of technologies and potential adopters. The matching algorithm combines contextual, farm and technology characteristics to create a ranking of the suitability and adoption probability of available innovations. | | | | | | | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | | | | | | | |
| 2.1 Test and improve the ‘matching’ algorithm on a large dataset | | | | | | | | | | | | | | | | |
| 2.2 Determine the ease of scarce data collection at farms | | | | | | | | | | | | | | | | |
| 2.3 Obtain feedback from farmers on the technology priority lists | | | | | | | | | | | | | | | | |
| 2.4 Develop a mechanism for feeding collected data to the database and improve algorithm learning | | | | | | | | | | | | | | | | |
| 2.5 Develop the ‘signaling’ algorithm | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | | | | | | | |
| 3.1 What is the quality of the generated priority lists for large samples of farms in different agroecological and socio-economic conditions? | | | | | | | | | | | | | | | | |
| 3.2 Can the necessary set of scarce data be collected swiftly and reliably from farmers upon farm visit? | | | | | | | | | | | | | | | | |
| 3.3 What is the farmer perception of the generated priority list of technologies suggested for implementation? | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | | | | | | | |
| * Data collection: GIS and ARBES databases for intervention areas in Tanzania and Malawi will be used to select 1 km2 grid cells with surveyed households. A minimal set of supplementary data on farm and household features and on-farm technologies and practices may be collected. * We select 35-50 grid cells of 1 km2 from the three regions of Tanzania (Babati, Kongwa, Kiteto) and two districts in Malawi (Dedtza, Ntcheu), so 5-10 cells per region. These cells differ in biophysical conditions (soil, rainfall, etc.) and socio-economic circumstances (e.g. distance to market). Moreover, within these cells we have at least 10 households sampled within the ARBES database collected by IFPRI; if this is not the case then additional data collection is required. In total ca. 300 farms will be included. There should also be diversity among the sampled households in the grid cell. For each household, we analyze in particular the main, easy to collect farm and household features (size, objectives, livestock, crop number, % off-farm income, etc.) and relate these to the farm practices and project-proposed technologies and techniques. The matching algorithm combines the GIS-derived data on biophysical conditions and socio-economic context circumstances with the farm features, to estimate the probability of use of the various technologies and techniques. The data set will be divided between a training set (n=200-240) and a testing set (n=60-100). | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 5. Data (with metrics) to be collected and uploaded on Dataverse. Generally, not applicable given that a tool is being piloted, rather than validating a technology. However, the information below will be collected. | | | | | | | | | | | | | | | | |
| Domain | | | | | Indicator | | | | | | | Metric and scale | | | | |
| Non-domain data: | | | | | Compiled datasets  Programmed algorithms | | | | | | |  | | | | |
| Human condition | | | | | Capacity to experiment | | | | | | | Willingness to implement a new farm configuration after disturbance | | | | |
| Social | | | | | Equity | | | | | | | Rating of farm configurations per group and agency (leadership roles) | | | | |
|  | | | | | | | | | | | | | | | | |
| 6. Deliverables | | | | | | Means of verification | | | | | | | | Delivery date | | |
| 6.1 Journal article submitted | | | | | | PDF of submitted papers | | | | | | | | Sep. 2020 | | |
| 6.2 MSc thesis student report | | | | | | PDF report | | | | | | | | Sep 2020 | | |
| 6.3 Datasets and algorithms | | | | | | Items uploaded in Dataverse | | | | | | | | Sep. 2020 | | |
|  | | | | | | | | | | | | | | | | |
| 7. How will scaling be achieved? | | | | | | | | | | | | | | | | |
| The modelling results will be discussed in farmer meetings. Findings will be shared and published. | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 8. How are activities in this protocol inked to those of others? N/A | | | | | | | | | | | | | | | | |
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9. Gantt chart



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| --- | --- | --- | --- | --- |
| Outcome 5: Partnerships for the scaling of sustainable intensification research products and innovations operationalized | | | | |
| a. Output 5.1 | | | Opportunities for the use and adoption of sustainable intensification technologies identified for relevant farm typologies | |
| b. Activity 5.1.7 | | | Conduct cost-benefit and gender analysis coupled with other socio-economic analyses to identify and quantify adoption constraints and opportunities for different farmer contexts | |
| c. Sub activity 5.1.7.1. | | | Socio-economic studies on cost/benefits of CA systems, labor, nutrition and gender in target communities of Malawi and Zambia conducted | |
|  | | | | |
| d. Systems research team | | | | |
| Name | | Institution | | Role |
| Munyaradzi Mutenje | | CIMMYT | | PI, research conceptualization, design, socio-economic research |
| Mphatso Gama | | Machinga ADD | | Implementation |
| Mulundu Mwila | | ZARI | | Implementation |
| Richard Muzeka | | TLC | | Implementation |
|  | | | | |
| e. Students: Nil | | | | |
|  | | | | |
| f. Locations | Malawi and Zambia | | | |
|  | | | | |
| g. Start date | October 2019 | | | |
|  | | | | |
| h. End date | September 2020 | | | |
|  | | | | |
| 1. Justification | | | | |
| Technology development in on-farm target communities needs to be enhanced by social and human data which is still incomplete. This is to support activities under 5.1.1.1. to complete the dataset. | | | | |
|  | | | | |
| 2. Objectives | | | | |
| To enhance uptake of the technology; to get a more complete understanding of social and human indicators; to understand the constraints and opportunities to SI adoption | | | | |
|  | | | | |
| 3. Research questions | | | | |
| 3.1 How can the constraints and opportunities related to the uptake of SI technologies by target communities be better understood? | | | | |
|  | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | |
| Experiment design, implementation and data analysis:  Participatory Rural Appraisal, analysis of the previous on-farm level and survey data collected in 2019 | | | | |
|  | | | | |
| 5. Data (with indicators and metrics) to be collected and uploaded on Dataverse | | | | |

|  |  |  |  |
| --- | --- | --- | --- |
| SI Domain & *Indicator* | Field/plot level metrics | Household level metrics | Measurement method |
| Productivity | | | |
| *Data taken in 5.1.1.1* |  |  |  |
| Economic | | | |
| *Profitability* | Gross margin (USD/ha/season) |  | PRA |
| *Returns to land, labor, input* | Returns to investment |  | Survey |
| *Labor requirement* | Labor requirements |  | Survey |
| *Labor requirement* | Farmers’ rating of labor |  | PRA |
| Environment | | | |
| *Data taken in 5.1.1.1* |  |  |  |
| Social | | | |
| *Equity (generally)* | Rating of technologies by gender |  | PRA |
| *Gender equity* |  | Women’s time and empowerment index | Survey |
| Human | | | |
| *Nutrition* | Protein production (g/ha) |  | Survey |
| *Nutrition* |  | Dietary diversity score | Survey |
| *Nutrition* |  | Food consumption score | Survey |
| *Food security* |  | Months of food insecurity | Survey |
| *Food security* |  | Food security composite Index | Survey |
| *Food security* |  | Rating of Food security | Survey |

|  |  |  |
| --- | --- | --- |
|  | | |
| *Other domains are done under activity 5.1.1.1 and the data will complement the other biophysical data* | | |
|  | | |
| 6. Deliverables | Means of verification | Delivery date |
| 6.1 Field protocols updated and available | Instrument developed | Jan. 2020 |
| 6.2 PRA conducted | Survey commissioned | Apr. 2020 |
| 6.3 Survey data analyzed | Report | Jun. 2020 |
| 6.4 Field data analyzed and presented in project meetings | Presentation, Report | Sep. 2020 |
| 6.5 Upload data into Dataverse | Data uploaded | Sep. 2020 |

|  |
| --- |
|  |
| 7. How will scaling be achieved? |
| Malawi extension system mainstreaming activities in different districts; Total Land Care and other NGOs will be exposed to the technology for possible scaling; Data from socio-economic studies will support Proof of Concept |
|  |
| 8. How are the activities in this protocol linked to those of others? |
| MSU and CIMMYT are collaborating under 5.1.1.2 and the data generated will further validate the research data collected under this activity |

9. Gantt chart

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **2019** | | | **2020** | | | | | | | | |
| **Activity** | **Oct** | **Nov** | **Dec** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | |
| Planning and contracting |  |  |  |  |  |  |  |  |  |  |  |  | |
| Development of subgrants with partners |  |  |  |  |  |  |  |  |  |  |  |  | |
| Procurement of inputs |  |  |  |  |  |  |  |  |  |  |  |  | |
| Trial implementation |  |  |  |  |  |  |  |  |  |  |  |  | |
| Selection of sites for MSc study |  |  |  |  |  |  |  |  |  |  |  |  | |
| Monitoring and evaluation |  |  |  |  |  |  |  |  |  |  |  |  | |
| Bio-physical data taking |  |  |  |  |  |  |  |  |  |  |  |  | |
| Case studies |  |  |  |  |  |  |  |  |  |  |  |  | |
| Socio-economic surveys |  |  |  |  |  |  |  |  |  |  |  |  | |
| Field and study tours to target communities |  |  |  |  |  |  |  |  |  |  |  |  | |
| Student supervision |  |  |  |  |  |  |  |  |  |  |  |  | |
| Writing of bi-annual report |  |  |  |  |  |  |  |  |  |  |  |  | |
| Field days and evaluation meetings |  |  |  |  |  |  |  |  |  |  |  |  | |
| Collection of field data |  |  |  |  |  |  |  |  |  |  |  |  | |
| Analysis of field data |  |  |  |  |  |  |  |  |  |  |  |  | |
| Evaluation meetings in country |  |  |  |  |  |  |  |  |  |  |  |  | |
| Data upload into Dataverse |  |  |  |  |  |  |  |  |  |  |  |  | |
| Africa RISING meeting |  |  |  |  |  |  |  |  |  |  |  |  | |

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| Outcome 5: Partnerships for the scaling of sustainable intensification research products and innovations operationalized | | | |
| a. Output 5.1 | | Opportunities for the use and adoption of sustainable intensification technologies identified for relevant farm typologies | |
| b. Activity 5.1.7 | | Conduct cost-benefit and gender analysis coupled with other socio-economic analyses to identify and quantify adoption constraints and opportunities for different farmer contexts | |
| c. Sub-activity 5.1.7.2 | | Gender analysis of soil and water conservation technologies | |
|  | | | |
| d. Research team | | | |
| Name | Institution | | Role |
| Gundula Fischer | IITA | | PI, gender analysis, social science research, supervision of MA students from the University of Dodoma |
| Elirehema Swai | TARI, Hombolo | | Generate and provide the biophysical domains data for technologies described in 1.2.2.1 and 2.2.1.6 |
| Julius Anatory  Zamaradi Said | MA students, University of Dodoma, Department of Development Studies | | Gender analysis of rip tillage |
|  | | | |
| e. Locations | Kongwa and Kiteto districts | | |
|  | | | |
| f. Start date | The gender studies in support of Sub-activity 1.2.2.1 will start in October 2019, while those for Sub-activity 2.2.1.6 started in the 2018/2029 season. | | |
|  | | | |
| g. End date | September 2020 | | |
|  | | | |
| 1. Justification | | | |
| Africa RISING has evaluated the biophysical performance of soil and water conservation technologies, being rip tillage (sub-activity 1.2.2.1), annual and residual tied ridges as well as fanya juu terraces (sub-activity 2.2.1.6) in the districts of Kongwa and Kiteto since 2016/2017. Collection of the social domain validation data started during 2018/2019 for the tied ridges and fanya juu technologies, while those for rip tillage will start during the 2019/2020 cropping season. Two MSc students from University of Dodoma will conduct an in-depth study of gender in relation to the rip technology as compared to conventional tillage methods. The gender analysis will be based on SIAF. Its findings will support the co-adaptation of the technology with target communities.  During the 2018/2019 cropping season, substantial gender information on fanya juu terraces and tied ridging technologies were collected in four villages, namely Laikala, Mlali, Nghumbi and Sagara in semi-arid areas of Kongwa district and are being analyzed. In the 2019/2020 cropping season, we will follow-up and fill identified gaps (such as perceptions on drudgery). | | | |
|  | | | |
| 2. Objectives | | | |
| 2.1 To conduct a gender analysis of the rip tillage technology based on SIAF | | | |
| 2.2 To explore the social dynamics and institutions of the collective action groups smallholder farmers have established for fanya juu terraces and tied ridges | | | |
| 2.3 To measure and understand the drudgery perceptions of men and women who use residual tied ridging as compared to flat cultivation | | | |
|  | | | |
| 3. Research questions | | | |
| 3.1 How do men and women farmers evaluate rip tillage in the various domains of SIAF? | | | |
| 3.2 What is the innovation history of rip tillage in the two villages and how has it influenced the uptake of the technology? | | | |
| 3.3 What are the social dynamics and institutions that shape farmers collective action in terms of fanya juu and tied ridges? What would be inclusive and sustainable group models? | | | |
| 3.4 What are men and women farmers’ perceptions of the drudgery involved in residual tied ridging as compared to flat maize cultivation? | | | |
|  | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | |
| Gender evaluation methodology:  The methods to be used will include data collection on the collective action groups that the villagers have established to practice soil and water conservation technologies. Individual interviews will provide more room for group members to express their views, especially on conflicts. We will, therefore, employ individual semi-structured interviews for the follow-up investigations, as follows:   * Approach: gender analysis questions mainstreamed through SIAF domains. * Individual semi-structured interviews with members and leaders of collective action groups for sub-activity 2.2.1.6 * Participatory exercises for drudgery scores for sub-activity 2.2.1.6 * Focus group discussion and participatory exercises for sub-activity 1.2.2.1. * Sampling: Purposive sampling (farmers who have sufficient experience with the technology; members and leaders of collective action groups, gender-balanced sample). * Qualitative data collected through focus group discussions and semi-structured interviews will be transcribed and analyzed with the qualitative data analysis software Atlas.ti.   An expanded methodological approach is described in the appended research protocol. | | | |
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| 5. Data to be collected and uploaded on Dataverse (see protocol for details) | | | |

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| Domain & *Indicator* | Household level metrics | Community/  landscape | Method |
| Economic | | | |
| *Labor requirement (for follow-up study)*  *Profitability (already collected)* | Farmer rating of labor |  | Drudgery scores |
| Social | | | |
| *Social cohesion* |  | Participation in social groups | Individual interviews |
| *Collective action* |  | Collective action groups |
| *Gender equity* | Gender preferences |  | Focus group discussions,  participatory exercises, survey |

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| 6. Deliverables | Means of verification | Delivery date |
| 6.1 Recommendations (fanya juu and tied ridges) | Bi-annual reports | Mar. 2020, Sep. 2020 |
| 6.2 Recommendations (rip tillage) | MA theses submitted | Sep. 2020 |

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| 7. How will scaling be achieved? |
| The scaling approaches have been described in sub-activities 1.2.2.1 and 2.2.1.6 |
|  |
| 8. How are the activities in this protocol linked to those of others? |
| This sub-activity is generating the social domains validation data for technologies described in sub-activities 1.2.2.1 and 2.2.1.6. |

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| Outcome 5: Partnerships for the scaling of sustainable intensification research products and innovations operationalized | | |
| a. Output 5.1 | Opportunities for the use and adoption of sustainable intensification technologies identified for relevant farm typologies | |
| b. Activity 5.1.7 | Conduct cost-benefit and gender analysis coupled with other socio-economic analyses to identify and quantify adoption constraints and opportunities for different farmer contexts | |
| c. Sub activity 5.1.7.3 | Innovative farmer survey applying SI principles in CA long-term trials in Malawi and Zambia | |
|  | | |
| d. Systems research team | | |
| Name | Institution | Role |
| Munyaradzi Mutenje | CIMMYT | PI, research conceptualization, design, socio-economic research |
| Mphatso Gama | Machinga ADD | Implementation |
| Mulundu Mwila | ZARI | Implementation |
| Richard Muzeka | TLC | Implementation |
|  | | |
| e. Student(s): Nil | | |
|  | | |
| f. Location(s) | Malawi and Zambia | |
|  | | |
| g. Start date | October 2019 | |
|  | | |
| h. End date | September 2020 | |
|  | | |
| 1. Justification | | |
| Understand adaptation, adoption, trajectories and impact pathways of smallholder farmers in different agro-ecological areas. For proper targeting, we need to better understand the innovative farmers and learn from them | | |
|  | | |
| 2. Objectives | | |
| To understand farmers’ behavior and decision making at household level, understand the household gender dynamic and decision making. | | |
|  | | |
| 3. Research questions | | |
| 3.1 How do farmers’ gender and behavior guide the dynamic decision making at household level? | | |
|  | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | |
| Experiment design, implementation and data analysis:  Detailed Farmer discussion and analysis following a structured interview, detailed livelihood analysis at farm scale | | |
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| 5. Data (with metrics) to be collected and uploaded on Dataverse | | |

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| SI Domain & *Indicator* | Field/plot level metrics | Farm level metrics | Household level metrics | Measurement method |
| Productivity | | | | |
| *Crop productivity* | Yield (kg/ha/season) | total farm production (kg/ha/farm) |  | Interview |
| *Crop biomass productivity* | Residue production (kg/ha/season) |  |  | Interview |
| Economic | | | | |
| *Profitability* | Gross margin (USD/ha/season) |  | Net income in $/ha/season | Interview |
| *Returns to land, labor and inputs* | Returns to investment |  |  | Interview |
| *Labor requirement* | Labor requirements |  |  | Interview |
| *Labor requirement* | Farming rating of labor |  |  | Interview |
| Environment | | | | |
| *Erosion* | Rating of soil erosion |  |  | Interview |
| Social | | | | |
| *Equity (generally)* | Rating of technologies by gender |  |  | Interview |
| Human | | | | |
| *Nutrition* | Protein production (g/ha) |  |  | Survey |
| *Nutrition* |  |  | Dietary diversity score | Survey |
| *Nutrition* |  |  | Food consumption score | Survey |
| *Food security* |  |  | Month of food insecurity | Survey |
| *Food security* |  |  | Food security composite Index | Survey |
| *Food security* |  |  | Rating of Food security | Survey |

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| 6. Deliverables | Means of verification | Delivery date |
| 6. 1 Survey protocols available | Field protocols | Jan. 2020 |
| 6.2 Survey conducted | Survey commissioned | Apr. 2020 |
| 6.3 Field data analyzed and presented in project meetings | Presentation, Report | Sep. 2020 |
| 6.4 Upload data into Dataverse | Data uploaded | Sep. 2020 |

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| 7. How will scaling be achieved? |
| No direct scaling is expected from this activity |
|  |
| 8. How are the activities in this protocol linked to those of others? |
| MSU and CIMMYT are collaborating under 5.1.1.2 and the data will further validate the research data collected under this activity. |
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9. Gantt chart

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|  | **2019** | | | **2020** | | | | | | | | | |
| **Activity** | **Oct** | **Nov** | **Dec** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** |
| Planning and contracting |  |  |  |  |  |  |  |  |  |  |  |  |
| Development of subgrants with partners |  |  |  |  |  |  |  |  |  |  |  |  |
| Procurement of inputs |  |  |  |  |  |  |  |  |  |  |  |  |
| Trial implementation |  |  |  |  |  |  |  |  |  |  |  |  |
| Selection of sites for MSc study |  |  |  |  |  |  |  |  |  |  |  |  |
| Monitoring and evaluation |  |  |  |  |  |  |  |  |  |  |  |  |
| Bio-physical data taking |  |  |  |  |  |  |  |  |  |  |  |  |
| Case studies |  |  |  |  |  |  |  |  |  |  |  |  |
| Socio-economic surveys |  |  |  |  |  |  |  |  |  |  |  |  |
| Field and study tours to target communities |  |  |  |  |  |  |  |  |  |  |  |  |
| Student supervision |  |  |  |  |  |  |  |  |  |  |  |  |
| Writing of bi-annual report |  |  |  |  |  |  |  |  |  |  |  |  |
| Field days and evaluation meetings |  |  |  |  |  |  |  |  |  |  |  |  |
| Collection of field data |  |  |  |  |  |  |  |  |  |  |  |  |
| Analysis of field data |  |  |  |  |  |  |  |  |  |  |  |  |
| Evaluation meetings in country |  |  |  |  |  |  |  |  |  |  |  |  |
| Data upload into Dataverse |  |  |  |  |  |  |  |  |  |  |  |  |
| Africa RISING meeting |  |  |  |  |  |  |  |  |  |  |  |  |

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| Outcome 5: Partnerships for the scaling of sustainable intensification research products and innovations operationalized | | | | | | | | |
| a. Output 5.2 | | | Strategic partnerships with public and private, initiatives for the diffusion, and adoption of research products | | | | | |
| b. Activity 5.2.1 | | | Leverage/link and integrate (engagement and outreach) with existent initiatives including Government extension systems to support and encourage the delivery pathways | | | | | |
| c. Sub-Activity 5.2.1.1 | | | Engage able and willing partners to develop a strategy and implementation framework for scaling-up intensification research technologies in semi-arid ecologies of central Tanzania | | | | | |
|  | | | | | | | | |
| d. Research team | | | | | | | | |
| Name | | | | Institution | | Role | | |
| Patrick Okori | | | | ICRISAT (PI) | | Lead engagement activities with partners, coordinate assembly of data | | |
| Haroon Sseguya | | | | IITA | | Co-Investigator who will support our scaling out work, such as review of implementation and opportunity for work in Iringa | | |
| Arkadeep Bandyopadhyay | | | | IFPRI/IITA (ESA M&E) | | M&E Support | | |
| Extension officers | | | | DAICO, Kiteto, Kongwa, | | Backstop the AR and private sector as appropriate | | |
| DASPA | | | | Farmer groups in Kongwa and Kiteto | | Implement the community bank program for seed production and access. The leadership will also coordinate with ICRISAT the lead agency for this activity | | |
|  | | | | | | | | |
| e. Students: Nil | | | | | | | | |
|  | | | | | | | | |
| f. Location(s) District, Village | | Kongwa District, Villages-Chitego, Mlali, Laikala and Moleti; Kiteto District- Villages-Njoro or Kiperesa and Iringa District, Village-Igula | | | | | | |
|  | | | | | | | | |
| g. Start date | | | | November 2014 | | | | |
|  | | | | | | | | |
| h. End date | | | | September 2020 | | | | |
|  | | | | | | | | |
| 1. Justification | | | | | | | | |
| In the 2018-2019 cropping season, under sub-activity 5.2.1.1 we studied the role of power relationships among the “farming system” stakeholders to inform the scaling-out strategy for the new technologies. Key findings from that study that have informed the 2019-2020 activities are provided below:   1. Culture influences gender relations and land ownership but does not affect access to knowledge and technologies by farming populations. Key actors providing knowledge in Kongwa and Kiteto are mostly public institutions i.e., extension, researchers and or civil society agencies operating at community level. The private sector plays a lesser role with agro-dealers and aggregators being key in knowledge delivery. The power relationships among these key actors generally promote inclusion rather than competition and exclusion. 2. The nature of these key players (public and civil society) makes them not-for-profit based, and therefore, have limited direct role in improving farm household incomes. 3. The groundnut value chain studies showed that public institutions are the dependent source of improved material i.e., ICRISAT or relevant TARI institutes. Improved seed production-to-delivery is mostly dependent on civil society and farmer groups. 4. Improving seed systems to deliver technologies, requires among others, building seed value chains from the supply side, starting with informal systems to increase awareness, and promote new material to create demand as a foundation for the private sector investment in improved seed delivery.   In the 2018-2019 season, we did not sign Memoranda of Understanding because we wanted this study to inform the nature and partnerships needed given that these crops are generally underinvested. It was therefore not as simple as signing MoU with seed traders. We have since identified the right sort of partnership needed. Accordingly, this year (2019-2020), we plan to work with DASPA, a community-based organization we found active in partnership with local government to roll out improved seed and allied technologies. A Tripartite MoU involving (i) DASPA, (ii) ICRISAT/TARI and (iii) respective DAICOs, will be developed to guide scaling out of groundnut, pigeon pea, sorghum and pearl millet in Kongwa and Kiteto. This MoU will guarantee access to the early generation of improved seed by DASPA from TARI and or ICRISAT. DASPA will produce certified seed with its membership becoming the first customers improved seed provider. The DAICOs will support knowledge dissemination being the main source of knowledge dissemination as found our power relations studies. For Iringa, we will leverage the ongoing work of Africa RISING’s Scaling project led by IITA. This is the next logical step after the 2018-2019 power relations meetings/work. | | | | | | | | |
|  | | | | | | | | |
| 2. Objectives | | | | | | | | |
| 2.1 Establish a partnership for scaling out underinvested crops: groundnut, pigeon pea, sorghum and pearl millet and allied innovations in Kongwa and Kiteto. DASPA is a stakeholder that we have identified recently more especially after the 2018-2019 study that clearly shows that civil societies and public agencies are critical for scaling out under-invested crops. The logical step, therefore, is to enter into strategic partnerships with organizations such as DASPA with whom we would like to conclude an MoU. | | | | | | | | |
| 2.2 Promote the adoption of improved groundnut, pigeon pea, sorghum and pearl millet and allied innovations in Kongwa and Kiteto reaching at least 4000 households as beneficiaries of quality seed to create demand for improved seed. | | | | | | | | |
| 2.3 Review together with Africa RISING Scaling Project opportunities for scaling out sorghum and pigeon pea seed technologies to Iringa. If workable, MoU will be developed to frame the partnership for technology delivery. | | | | | | | | |
|  | | | | | | | | |
| 3. Research questions | | | | | | | | |
| 3.1 Does stakeholder engagement enhance delivery of technologies and productivity in farming systems? | | | | | | | | |
| 3.2 What are the needed interventions to improve the functionality of the weak multi-stakeholder-based technology generation to delivery systems? | | | | | | | | |
|  | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | |
| Experiment design, implementation and data analysis:  Partner engagement. We will leverage the existing partnership (Africa RISING with DAICOs and TARI) and create a new one that also leverages ICRISAT’s working relationship with DASPA to implement this activity. A planning and contract design meeting will be held in Dodoma involving DASPA, TARI/ICRISAT and respective DAICO of Kongwa and Kiteto. The IITA led Africa RISING Scaling Project that operates in Iringa and Mbeya will be invited to discuss potential opportunities for scaling out. An MoU will be designed and following approval, signed by all parties.  Work design. The informal community seed bank model (Munthali and Okori, 2018[[25]](#footnote-25)), tested in Kongwa and Kiteto that led to the availability of quality pigeon pea seed in central Tanzania and other locations in East and southern Africa, will be adopted. Co-creation and designing including capacity building will be embraced, thus DASPA field staff, DAICO extension staff and TARI staff will be trained to transfer “the technology.” Community seed banks rely on farmer clubs for production, management and sale of seed as quality declared seed (QDS). We will use existing DASPA seed production clubs training then to include market and community-based approaches in seed production and sales. The DAICOs will be part of the knowledge delivery team in this tripartite arrangement, to expand the footprint of DASPA in our focus project sites as framed by the MoU. This way, we envisage genuine commitment and accountability, critical elements of any tur partnerships. This activity will also benefit from Sub-Activity 5.1.1.2, usingthe demonstrations as learning, exposure, technology dissemination sites and field days. | | | | | | | | |
|  | | | | | | | | |
| 5. Data to be collected and uploaded on Dataverse | | | | | | | | |
| Domain & *Indicator* | Farm level metrics | | | | Household level metrics | | Community/landscape metrics | Measurement method |
| Economic | | | | | | | | |
| *Profitability* | Net income (Total net income for all farm activities) | | | | Net income (Total net income for all farm activities) | |  | Participatory Evaluation |
| Social | | | | | | | | |
| *Social cohesion* | Participation in community activities | | | | Participation in community activities | | Incidence of social support to value chain and IPs | Focus group discussions |
| Human condition | | | | | | | | |
| *Capacity to experiment* |  | | | | Number of new practices being tested | | Percentage of farmers experimenting | Focus group discussions |

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| 6. Deliverables | Means of verification | Delivery date |
| 6.1 A planning meeting held to agree on the MOU terms involving DASPA, TARI/ICRISAT and respective DAICO’s of Kongwa and Kiteto districts | Project progress reports | Nov. 2019 |
| 6.2 A MOU guiding implementation of this activity drafted for signing by respective institution leads | Partnership MoU | Dec. 2019 |
| 6.3 Farmer groups mobilized and engaged for the activity with a target to reach at least 4,000 farmers | Project progress reports | Nov. 2019 |
| 6.4 Stakeholders trained in community seed banks | Project progress reports | Dec. 2019 |
| 6.5 Monitoring, trainings and partnership support | Project progress reports | Sep. 2020 |
|  | | |
| 7. How will scaling be achieved? | | |
| This is a scaling out activity to be implemented via a strategic partnership involving local seed producer association (DASPA) and research institution (ICRISAT and relevant TARI-centers), to supply the varieties and the DAICOs office, to provide extension support and linkage to TOSCI, the seed industry regulatory agency. | | |
|  | | |
| 8. How are the activities in this protocol linked to those of others? | | |
| The Gender Team IITA, M&E regional Economist may use the platform established to collect data on topics such as the role of women in technology scaling and if the initiative stimulates seed demand by Agrodealers in central Tanzania. | | |
|  | | |

9. Gantt chart

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| --- | --- | --- | --- | --- |
|  | **Sub-activity 5.2.1.1** | Start | End | Workdays |
| 1. | Planning meeting to agree on MoU | Fri 11/01/19 | Fri 11/22/19 | 16 |
| 2. | MoU drafting and signing | Fri 12/20/19 | Mon 12/30/19 | 7 |
| 3. | Farmer mobilization and stakeholder engagement | Mon 11/04/19 | Wed 11/27/19 | 18 |
| 4. | Stakeholder/farmer trainings | Mon 11/04/19 | Fri 11/29/19 | 20 |
| 5. | Monitoring, training and partnership support | Wed 11/20/19 | Wed 9/30/20 | 226 |

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| Outcome 5: Partnerships for the scaling of sustainable intensification research products and innovations operationalize | | | | | |
| a. Output 5.2 | Strategic partnerships with public and private, initiatives for the diffusion, and adoption of research products | | | | |
| b. Activity 5.2.2 | Leverage/link and integrate (engagement and outreach) with existent initiatives including Government extension systems to support and encourage the delivery pathways | | | | |
| c. Sub activity 5.2.2.1 | Support the Ministry of Agriculture and NGO Extension in scaling CA-systems in Eastern Zambia and Malawi | | | | |
|  | | | | | |
| d. Research team | | | | | |
| Name | | Institution | | Role | |
| Christian Thierfelder | | CIMMYT | | PI, research conceptualization, design, socio-economic research | |
| Mphatso Gama | | Machinga ADD | | Implementation | |
| Mulundu Mwila | | ZARI | | Implementation | |
| Richard Museka | | TLC | | Implementation | |
| Geoff Heinrich | | CRS | | Implementation | |
|  | | | | | |
| e. Students: Nil | | | | | |
|  | | | | | |
| f. Locations | Malawi, Zambia | | | | |
|  | | | | | |
| g. Start date | October 2019 | | | | |
|  | | | | | |
| h. End date | September 2020 | | | | |
|  | | | | | |
| 1. Justification | | | | | |
| For adaptation, adoption and sustainable uptake, we need to co-develop technologies with local partners and engage at different levels. We intend to share research results to different audiences at different levels and at different times within the target countries. | | | | | |
|  | | | | | |
| 2. Objectives | | | | | |
| To enhance the scaling of conservation agriculture in rural communities of Malawi and Zambia. | | | | | |
|  | | | | | |
| 3. Research questions | | | | | |
| Not applicable | | | | | |
|  | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | |
| Experiment design, implementation and data analysis:  Ministry of Agriculture and NGO partners will be actively involved in the management and evaluation of on-farm trials to get firsthand experiences and data of the technologies to be scaled. We plan to share data and knowledge with local partners in various events. | | | | | |
|  | | | | | |
| 5. Data (with metrics) to be collected and uploaded on Dataverse | | | | | |
| SI Domain (no specific domain will be addressed as the activity will not involve taking field level data but more creating an enabling environment). | | | | | |
|  | | | | | |
| 6. Deliverables | | | Means of verification | | Delivery date |
| 6.1 Evaluation meetings of technology interventions | | | Field protocols and data | | Mar. 2020 |
| 6.2 Study tours with key players | | | Study tour report | | Mar. 2020 |
| 6.3 Field days conducted | | | Bi-annual reports | | Sep. 2020 |
| 6.4 CA systems scaled at least to 10,000 farmers in Malawi and Zambia | | | Annual Report, adoption monitoring | | Sep. 2020 |

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|  |
| 7. How will scaling be achieved? |
| Scaling will be achieved through active involvement of the Ministry of Agriculture Staff in Zambia and Malawi, interested NGOs and long-term partners (CRS and TLC), involvement of district committee personnel in field and study tours, field days, demonstrations and other community-based activities. Three types of scaling will be targeted: Scaling out (spatial scaling), scaling-up (make institutions change) and scaling deep (achieve behavioral change by farmers). |
|  |
| 8. How are the activities in this protocol linked to those of others? |
| MSU and CIMMYT are collaborating in extending technologies to local partners – we will intensify dialogue |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Outcome 5: Partnerships for the scaling of sustainable intensification research products and innovations operationalized | | | | | | | | |
| a. Output 5.2 | | Strategic partnerships with public and private, initiatives for the diffusion, and adoption of research products established | | | | | | |
| b. Activity 5.2.2 | | Leverage/link and integrate (engagement and outreach) with existent initiatives including Government extension systems to support and encourage the delivery pathways | | | | | | |
| c. Sub-activity 5.2.2.2 | | Engage with seed companies to accelerate release & scaling of new DT hybrids | | | | | | |
|  | | | | | | | | |
| d. Systems research team | | | | | | | | |
| Name | | Institution | Role | | | | | |
| Bright Jumbo | | CIMMYT | PI | | | | | |
| IFPRI | | IFPRI | To provide support in monitoring of the research activities to ensure compliance with the FtF monitoring system including periodically assisting in data collection (both FtF and Custom indicators data) with critical gender perspective and uploading into the FtF system | | | | | |
|  | | | | | | | | |
| e. Student(s) |  | | | |  |  | |  |
| Name | Institute | | | | Degree | Start | | End |
|  |  | | | |  |  | |  |
|  | | | | | | | | |
| f. Location(s) | | Dialogue and partnership arrangement with seed companies covering Arusha, Dodoma, Iringa | | | | | | |
|  | | | | | | | | |
| g. Start date | | October 2019 | | | | | | |
|  | | | | | | | | |
| h. End date | | September 2020 | | | | | | |
|  | | | | | | | | |
| 1. Justification | | | | | | | | |
| Justification: See research protocol  Drought-tolerant maize hybrids were evaluated in Kongwa and Kiteto in the validation trial during 2018/19 season. Four best hybrids have been identified for further evaluation at farm-level in mother-baby trials to generate productivity, economic, social and human condition information. These results can be used as support for the release of the new hybrids. However, the variety release process can be accelerated by involving the seed companies who can take it to scale after release. | | | | | | | | |
|  | | | | | | | | |
| 2. Objectives | | | | | | | | |
| 2.1 Identify and engage existing seed companies operating in the region to support the release of new DT hybrids and scaling | | | | | | | | |
| 2.2 Present information on the performance of new hybrids to promote them for up-take by seed companies | | | | | | | | |
| 2.3 Develop a roadmap with interested seed companies on the speedy release of superior DT hybrids. | | | | | | | | |
|  | | | | | | | | |
| 3. Research questions | | | | | | | | |
| 3.1 Can reaching out to existing networks/seed companies open opportunities for possible partnerships for scaling? | | | | | | | | |
| 3.2 Can seed companies support national performance trials of superior hybrids for release | | | | | | | | |
|  | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | |
| Experiment design, implementation and data analysis: See research protocols ESA 2019-2020.  We plan to conduct meetings with major seed companies covering Dodoma and Iringa regions and enter into non-binding MoUs with these seed companies to guide how we can work together to promote the new maize hybrids. During the meetings, we will present some performance data from our current yield and agronomic trials of new DT hybrids. The seed companies will choose hybrids and enter into CIMMYT’s standard product allocation process, and eventually, enter into commercialization licenses with CIMMYT for particular hybrids. The seed companies then place the allocated hybrids in National Performance Trials, after which the hybrids would be presented for release and eventually commercialized. | | | | | | | | |
|  | | | | | | | | |
| 5. Data (with metrics) to be collected and uploaded on Dataverse | | | | | | | | |
| *This activity will allow presenting data from previous experiments during meetings for review and generate information on other domains as indicated below (please refer to protocol # 4)* | | | | | | | | |
| *Domain/*  *Indicator* | | Metrics at Community/landscape level | | | | | Responsible institution | |
| *Social* | | | | | | | | |
| Equity | | Seed companies/agro-dealers linkages enabling agro-dealers’ participation in seed distribution or trade | | | | | CIMMYT | |
| Collective  Action | | The capacity of seed companies and agro-dealers to engage in the seed business | | | | | CIMMYT | |
| FtF indicator  4.5.2(12): | | The Number of public-private partnerships formed as a result of FtF assistance (S) | | | | | CIMMYT | |
|  | | | | | | | | |
| 6. Deliverables | | | | Means of verification | | | Delivery date | |
| 6.1 MoUs with at least three (3) interested seed companies | | | | Project progress reports, MoUs, meetings minutes | | | Aug. 2020 | |
| 6.2 Planned National Performance Trials (NPT) of new DT hybrids (These could be planted by TOSCI in 2021 season) | | | | Company field planning reports, meeting minutes | | | Aug. 2020 | |
| 6.3 Field days | | | | Field day reports | | | Aug. 2020 | |
|  | | | | | | | | |
| 7. How will scaling be achieved? | | | | | | | | |

|  |
| --- |
| This activity is part of the scaling process and successful engagement with the private seed companies has the potential to increase the investments in new DT hybrids fast track release by supporting NPT for variety release and subsequent seed production/commercialization that could lead to increased access by farmers and increased adoption. |
|  |
| 8. How are the activities in this protocol linked to those of others? |
| Technologies on soil and water conservation and good agronomic practices are critical to maximize variety productivity potential. During the variety release, information on GAP is needed, therefore approved/recommended new technologies on soil and water conservation as well as good agricultural practices would strongly support the release of new hybrids in this study. |
|  |

9. Gantt Chart

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **2019** | | **2020** | | | | | | | | | | | | |
| **Activity** | **Oct- Nov** | **Dec** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Send communication to seed companies for meeting engagement |  |  |  |  | X |  |  |  |  |  |  |  |  |  |
| Conduct meetings with seed companies |  |  |  |  |  | X | X | X |  |  |  |  |  |  |
| Agreements (MoUs) |  |  |  |  |  |  |  | X | X | X |  |  |  |  |
| Report write-up and submission |  |  |  |  |  |  |  |  |  | X | X |  |  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Outcome 5: Partnerships for the scaling of sustainable intensification research products and innovations operationalized | | | | | |
| a. Output 5.2 | | Strategic partnerships with public and private, initiatives for the diffusion, and adoption of research products | | | |
| b. Activity 5.2.2 | | Leverage/link and integrate (engagement and outreach) with existent initiatives including Government extension systems to support and encourage the delivery pathways | | | |
| c. Sub-activity 5.2.2.3 | | Partnership with Iles de Paix (IDP) for increasing the adoption of improved vegetable varieties and good agricultural practices (GAP) in vegetable production in 8 new villages in Karatu | | | |
|  | | | | | |
| d. Scaling team | | | | | |
| Name | Institution | | Role | | |
| Ludovic Joly | Iles de Paix (IDP) | | PI | | |
| Justus Ochieng | WorldVeg | | Technical backstopping of the scaling activities by IDP | | |
| IFPRI | IITA/IFPRI | | M&E Support | | |
|  | | | | | |
| e. Students: Nil | | | | | |
|  | | | | | |
| f. Locations: | 8 Villages in Karatu | | | | |
|  | | | | | |
| g. Start date | November 2019 | | | | |
|  | | | | | |
| h. End date | 30 September 2020 | | | | |
|  | | | | | |
| 1. Justification | | | | | |
| Partnership with IDP will ensure scaling out of vegetable technologies to reach several farmers in Karatu District. Through, scaling, other development agencies or initiatives that aim at taking technologies to scale like public and private extension services and a range of value chain actors would be interested in the technologies. The evidence base generated through this widespread scaling by IDP will help to catalyze further partnerships within the entire District that will put promising technologies and integrated interventions in the hands of millions of target rural households. WorldVeg will support IDP scaling approaches with technical backstopping and monitoring of scaling activities. | | | | | |
|  | | | | | |
| 2. Objectives | | | | | |
| To build the capacity of staff of IDP to efficiently scale out the vegetable technologies in 8 villages. | | | | | |
|  | | | | | |
| 3. Research questions | | | | | |
| Not applicable | | | | | |
|  | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | |
| Experiment design, implementation and data analysis:  Within the village: Targeted 350 direct beneficiary of the program must support at least 3 farmers from his/her village with at least one techniques or technology he benefited or learned from the program (350\*3= 1,050 farmers). WorldVeg will support IDP to track the beneficiaries of the technologies as required by USAID FTF indicator guidelines. | | | | | |
|  | | | | | |
| 5. Feed the Future (FTF) to be collected (Note: This being a scaling activity, collection of SIAF domains data is not applicable) | | | | | |
|  | | | | | 2020 Target |
| EG.3.2-25 Number of hectares under improved management practices or technologies with USG assistance [IM-level] | | | | | 24 |
| EG.3.2-24 Number of individuals in the agriculture system who have applied improved management practices or technologies with USG assistance [IM-level] | | | | | 818 |
| Value chain actor type: People in government | | | | | 15 |
| EG.3.2-2 Number of individuals who have received USG-supported degree-granting non-nutrition-related food security training [IM-level] | | | | | 3 |
| EG.3.2-7. Number of technologies, practices, and approaches under various phases of research, development, and uptake as a result of USG assistance [IM-level] | | | | | 4 |
|  | | | | | |
| 6. Deliverables | | | | Means of verification | Delivery date |
| 6.1 Provide technical backstopping to IDP to efficiently scale the technologies in 8 villages | | | | Technical report | Sep. 2020 |
|  | | | |  |  |
| 7. How will scaling be achieved? N/A | | | | | |
|  | | | | | |
| 8. How are the activities in this protocol linked to those of others? N/A | | | | | |
|  | | | | | |

9. Gantt chart

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **2019** | | **2020** | | | | | | | | | | | | |
| Activity | Oct-Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| Send communication to seed companies for meeting engagement |  |  |  |  | X |  |  |  |  |  |  |  |  |  |
| Conduct meetings with seed companies |  |  |  |  |  | X | X | X |  |  |  |  |  |  |
| Agreements (MoUs) |  |  |  |  |  |  |  | X | X | X |  |  |  |  |
| Report write-up and submission |  |  |  |  |  |  |  |  |  | X | X |  |  |  |

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| --- | --- | --- | --- | --- | --- | --- |
| Project Outcome 5: Partnerships for the scaling of sustainable intensification research products and innovations operationalized | | | | | | |
| a. Output 5.2 | | Strategic partnerships with public and private, initiatives for the diffusion, and adoption of research products established | | | | |
| b. Activity 5.2.2 | | Leverage/link and integrate (engagement and outreach) with existent initiatives including Government extension systems to support and encourage the delivery pathways | | | | |
| c. Sub-activity 5.2.2.4 | | Partnership with LEAD Foundation to take to scale soil and water management technologies in erosion-prone areas of Central Tanzania | | | | |
|  | | | | | | |
| d. Systems research team | | | | | | |
| Name | Institution | | Role | | | |
| Elirehema Swai | TARI Hombolo | | PI will liaise with LEAD Foundation, extension officers and lead farmers | | | |
| Director -LEAD Foundation | LEAD Foundation, Dodoma | | Provide a platform for engagement of champions and farmers who have installed terraces in their field | | | |
| Anthony Kimaro | ICRAF | | Coordinate with LEAD Director on multipurpose tree species for reinforcing of bunds | | | |
|  | | | | | | |
| e. Students: NIL | | | | | | |
|  | | | | | | |
| f. Location(s): | Chamwino, Chemba, Mpwapwa, Kondoa and Kongwa Districts in semi-arid of Dodoma Region | | | | | |
|  | | | | | | |
| g. Start date | 2019/2020 | | | | | |
|  | | | | | | |
| h. End date | September 2021 | | | | | |
|  | | | | | | |
| 1. Justification | | | | | | |
| Africa RISING since 2014/2015 cropping season has invested substantial resources in developing and validating best technologies for addressing the problem of land degradation in semi-arid areas of Central Tanzania. These initiatives were geared on controlling soil erosion using Fanya juu/chini terrace technology, with the integration of Napier grass and Gliricidia multi-purpose tree on contour bunds for reinforcement. The identification of partners who are ready to engage and scale these technologies to other places with similar conditions is important. In July 2019, the LEAD Foundation, a non-governmental organization based in Dodoma Region which is engaged in environmental conservation, identified Fanya juu as their technology of interest. Africa RISING researchers were consulted and “Memorandum of Understanding” has been signed on modalities of partnering to scale it up (see Appendix 2). The LEAD Foundation has therefore requested Africa RISING implementing partners to support them by providing technical backstopping to lead farmers on matters regarding the installation of Fanya juu/chini terraces at plot level and community levels during the 2019/2020 cropping season. | | | | | | |
|  | | | | | | |
| 2. Objectives | | | | | | |
| 2.1 To strengthen the capacity of LEAD Foundation staff, extension staff in participating villages and lead farmers in soil and water management (S&WM) techniques for complex slopes to avoid failure of the S&WM structures. | | | | | | |
| 2.2 To establish demonstration plots in Dodoma region and at the Nane Nane agricultural show grounds, being learning sites for reaching wider farming communities | | | | | | |
| 2.3 To conduct farmers field days to showcase on how Fanya juu/chini terrace technologies are effective in controlling soil erosion | | | | | | |
| 2.4 To gather information on numbers of farmers who have installed Fanya juu/chini terraces and the total area installed with Fanya juu/chini terrace | | | | | | |
|  | | | | | | |
| 3. Research questions | | | | | | |
| Not applicable | | | | | | |
|  | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | |
| Activity implementation  LEAD Foundation has made a clear decision to rollout Fanya juu terrace in four districts of Dodoma region namely Chamwino, Chemba, Mpwapwa and Kongwa. Preliminary work of training champion farmers who will lead this process in their respective wards has been accomplished. During 2019/2020 cropping season, the following activities will be implemented:  i) *Training needs assessment (TNA) on installation of Fanya juu terrace*  The TNA exercise will be carried out in the target areas specifically for lead farmers and LEAD staff currently involved on installation of Fanya juu terrace under LEAD Foundation initiatives.  ii) *Capacity building of key implementers*  Arising from the training needs assessment results, capacity building of LEAD Foundation staff, extensionists in participating villages and lead farmers will be implemented.  iii) *Set up of demonstration on Fanya juu/chini terrace technology*  Installation of Fanya juu/chini terrace at demonstration plots in at least 5 villages in all 4 districts thus giving a total of 20 demonstrations, and the nanenane show grounds.  iv) *Conduct farmers field days*  In collaboration with LEAD Foundation, farmers’ field day will be conducted across sites to showcase how Fanya juu/chini terrace technologies are effective in controlling soil erosion.  v) *Data collection*  Information will be collected on the following: (i) area installed with Fanya juu/chini terraces. (ii) Number of farmers reached during 2019/2020 cropping (iii) farmer challenges and adaptation. | | | | | | |
|  | | | | | | |
| 5. Data (with metrics) to be collected and uploaded on Dataverse | | | | | | |
| *These data relate to the FtF indicators* | | | | | Responsible institution | |
| Number of lead farmers and LEAD Foundation staff trained on installation of Fanya juu/chini terraces under complex land terrain | | | | | TARI Hombolo, LEAD Foundation | |
| Number of Fanya juu/chini terrace demonstrations established under AR/LEAD Foundation partnership during 2019/2020 cropping season | | | | | TARI Hombolo, ICRAF | |
| Number of beneficiaries installed Fanya juu terrace in their fields during 2019/2020 under IITA/LEAD Foundation partnership quantified | | | | | TARI Hombolo, IITA, ICRAF | |
| Acreages installed with Fanya juu terrace in target districts in erosion-prone areas of central Tanzania | | | | | TARI Hombolo, IITA, ICRAF, LEAD Foundation | |
|  | | | | | | |
| 6. Deliverables | | | | Means of verification | | Delivery date |
| 6.1 At least twenty (20) demonstration sites installed with Fanya juu terrace established | | | | Progress Report | | Mar. 2020 |
| 6.2 At least 200 hectares owned by champion farmers installed with Fanya juu terrace during 2019/2020 cropping season | | | | Quarterly report | | May 2020 |
| 6.3 At least 500 farmers across four districts trained on use Fanya juu terrace technology during 2019/2020 through LEAD/Africa RISING partnership | | | | Progress Report | | Jul. 2020 |
| 6.4 Key challenges and success on installing of Fanya juu terrace technology in erosion-prone areas of Central Tanzania identified and quantified | | | | Progress Report | | Sep. 2020 |
| 6.5 At least 300 farmers exposed to Fanya juu/chini terrace technology during agricultural shows | | | | Progress Report | | Aug. 2020 |
| 6.6 At least 50 LEAD Foundation staff, lead farmers and extension personnels capacitated on installation of Fanya juu terrace techniques | | | | Capacity building Report | | Sep. 2020 |

7. Gantt chart

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **2019** | | **2020** | | | | | | | | | |
| **Activity** | | **Oct** | **Nov** | **Dec** | **Jan** | **Feb** | **Marc** | **Apr** | **May** | **Jun** | **July** | **Aug** | **Sept** |
| 1 | Planning meeting with LEAD Foundation on the data collection |  |  |  |  |  |  |  |  |  |  |  |  |
| 2 | Capacity building of LEAD Staff, extension workers villages and lead farmers in participating villages. |  |  |  |  |  |  |  |  |  |  |  |  |
| 3 | Establish demonstration on Fanya juu /chini terrace to showcase practice |  |  |  |  |  |  |  |  |  |  |  |  |
| 7 | Collect data on number of fields installed with Fanya juu terraces, numbers of farmers reaching |  |  |  |  |  |  |  |  |  |  |  |  |
| 9 | Data entry and processing |  |  |  |  |  |  |  |  |  |  |  |  |
| 10 | Report writing |  |  |  |  |  |  |  |  |  |  |  |  |
| 11 | Dataverse uploading |  |  |  |  |  |  |  |  |  |  |  |  |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Outcome 5: Partnerships for the scaling of sustainable intensification research products and innovations operationalized | | | | | | | | | | | | | | | | |
| a. Output 5.3 | | | | | Gender-sensitive decision support tools for farmers to assess technology-associated risk and opportunities used by partners | | | | | | | | | | | |
| b. Activity 5.3.1 | | | | | Identify and communicate gender-sensitive decision support technologies in the context of different farm typologies | | | | | | | | | | | |
| c. Sub-activity 5.3.1.1 | | | | | Role of gender from farm-to-fork and the market of grain legumes and dryland cereals in Kiteto and Kongwa” (continuing study from 2018/2019. Data already collected and partly presented in the annual report; more in-depth analysis is in progress) | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| d. Research team | | | | | | | | | | | | | | | | |
| Name | | | | | Institution | | Role | | | | | | | | | |
| Patrick Okori | | | | | ICRISAT (PI) | | Oversee implementation, quality assurance and reporting | | | | | | | | | |
| Wanjiku Gichohi | | | | | ICRISAT (Co-PI) | | * Conceptualize and design studies to answer research question * Coordinate assembly of data from both research and monitoring activities * Engage with other Africa RISING local and CGIAR partners | | | | | | | | | |
| Yacinta Muzanila | | | | | SUA Co-PI | | Planning supervision implementation of the studies | | | | | | | | | |
| IFPRI | | | | | IFPRI/IITA (ESA M&E) | | Provide support in monitoring of the research activities to ensure compliance to FtF monitoring system and uploading data into the FtF data management system | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| e. Student(s): | | | | | | | | | | | | | | | | |
| Name | | | Institute | | | Degree | | | | | Start | | End | | | |
| Felista Saluti | | | SUA | | | MSc. Policy Planning and Management | | | | | March 2019 | | March 2020 | | | |
|  | | | | | | | | | | | | | | | | |
| f. Location | | Kongwa, Kiteto and Iringa districts, Tanzania | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| Start date | | October 2018 | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| End date | | September 2020 | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 1. Justification | | | | | | | | | | | | | | | | |
| The team has used community banks to scale-out improved legumes and dryland cereals in Kongwa and Kiteto over the past two years, reaching 501 farmers with improved seed. An underlying principle of seed banks is that beneficiaries retain some seed. What they use it for is a grey area. Our assumption for this study is that beneficiary households retain excess seed as grain for own consumption as food or for sale and therefore such positive benefits may empower women. We learnt this in Malawi (The McKnight Annual Report, 2017[[26]](#footnote-26)), and believe, it will apply for semi-arid rural communities of Tanzania, who also face similar livelihood challenges. In Malawi and Tanzania, we have also observed a high interest in seed banks, especially by women. Given that the focus crops are generally described as women’s crops it is of interest to conduct a gender analysis to gain deeper understanding of its implications for sustainable intensification initiatives scaling out and research initiatives in Kiteto and Kongwa, Central Tanzania.  In the 2018-2019 project year, our study has focused on pigeon pea community seed banks, one of the avenues for technology delivery to the farming communities; and how being a beneficiary of such seed banks could influence women empowerment, maternal and child nutrition status. The study is crucial for understanding if legume community seedbanks contribute to nutrition and health for vulnerable groups. Social inequality and social inclusion are important for development (Anonymous, 2015[[27]](#footnote-27)). These issues are also critical for nutrition and income improvement. Increased gender-equal relations in farming households and communities lead to better agricultural and development outcomes, such as farm productivity and farm-house-hold nutrition improvements (Abakerli, 2012[[28]](#footnote-28)). These issues are also important for nutrition and income improvement. It should be noted that pigeon pea is generally produced as a cash-crop, with limited domestic consumption, hence the need to investigate the connection between the seed bank and livelihood improvement in general. The grain sold could be used to buy food for example and or meet other domestic gender productive needs. We initiated this study in 2019 but delayed its completion because the student undertaking it had not yet completed course work at SUA-Tanzania. We plan to complete data analysis in 2020, at a no cost. Key findings from the preliminary analysis of the relationship between pigeon pea seed bank beneficiaries and gender and nutrition outcomes show among others that:   1. Definitions of gender empowerment, especially production roles, are context specific. 2. Gender empowerment impacts on maternal and child nutrition but differs based on household structure, especially between female-adult headed households and male-headed adult households. 3. Child nutrition outcomes can best be attributed to a project in cases where children are within the first 1,000 days of the project life cycle. 4. Communities are aware of critical nutrient needs but do not necessarily relate them to food sources. Legumes and cereals may thus have different productive perspectives by households.   These results strengthen the Africa RISING reporting on Sustainable Indicators on human condition domain and social domain. | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | | | | | | | |
| Gain a better understanding between the relation community seed bank and the nutrition and health status of vulnerable groups | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | | | | | | | |
| 3.1 Does participation in seed production increase women empowerment of rural farming households? | | | | | | | | | | | | | | | | |
| 3.2 Does involvement in seed production through the community seed bank model result in improved maternal and child nutrition status? | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | | | | | | | |
| Experimental design, implementation and data analysis:  The community seed banks provide an easy mechanism for scaling-out improved crop varieties. Members of the seed bank may use part of the grain/seed for domestic consumption and/or may sale to gain income for their livelihoods. Community seed banks, therefore, provide an opportunity to test the potential linkage between access, utilization of new technologies and livelihood outcomes. Accordingly, this study is instituted to investigate the extent to which Africa RISING seed technologies influence in a positive way, gender, nutrition and income outcomes. Preliminary analysis has been done but detailed analysis using the FtF-USAID [project-Level Women’s Empowerment in Agriculture Index (pro-WEAI)](http://weai.ifpri.info/versions/pro-weai/) tool developed by IFPRI is on-going, and modification on analysis will be done following advice from IFPRI. Remaining work includes review and training of student on data management using the tool, analysis and report writing. The study will be executed through surveys and assessments such as focused group discussions, rapid rural appraisals and farming system surveys to identify gender gaps and develop a package to ensure gender equity in the region. Different methods of sampling including random and purposive sampling will be adapted. Questionnaires will be used as data capture tools. Both qualitative and quantitative data will be captured, and appropriate statistical tools will be used in the analysis. | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 5. Data to be collected and uploaded on Dataverse | | | | | | | | | | | | | | | | |
| Domain & *Indicator* | | | | Field/farm/  household metrics | | | | | | Community/  landscape metrics | | | | | Measurement method | |
| Social | | | | | | | | | | | | | | | | |
| *Gender Equity* | | | | Agency: Time allocation by gender  Market participation by gender  Achievements:  Income by gender  Nutrition/Food security by gender  Health status by gender | | | | | | Women Empowerment in Agriculture Index | | | | | Individual survey  Focus group discussions  Household survey | |
| *Social cohesion* | | | | Level and reliability of social support  Participation in community activities | | | | | | Participation in social groups | | | | | Focus group discussions  Household survey | |
| Human condition | | | | | | | | | | | | | | | | |
| *Food security* | | | | Food availability | | | | | |  | | | | | Survey | |
| *Capacity to experiment* | | | | No. of new practices being tested | | | | | | % of farmers experimenting | | | | | Focus group discussions | |
| *Nutrition* | | | | Nutritional status (underweight, stunting, wasting) | | | | | |  | | | | | Anthropometric measurements | |
|  | | | | | | | | | | | | | | | | |
| 6. Deliverables | | | | | | | | | Means of verification | | | | | | | Delivery date | |
| 6.1 Women empowerment as a result of access to yield-enhancing innovations and groups dynamics | | | | | | | | | Cross-sectional data as indicated in project progress reports | | | | | | | Mar. 2020 | |
| 6. 2 Nutrition indices associated with beneficiaries assembled to inform scaling out of innovations at community level | | | | | | | | | Anthropometric data in project progress reports | | | | | | | Mar. 2020 | |
| 6.3 Associations between empowerment, maternal and child nutrition outcomes established | | | | | | | | | Project progress reports, student thesis | | | | | | | Mar. 2020 | |
|  | | | | | | | | | | | | | | | | |
| 7. How will scaling be achieved? | | | | | | | | | | | | | | | | |
| The data collected will be combined with findings from outcome 3 to ensure that agriculture-based nutrition-sensitive approaches impact nutrition outcomes, and the findings will be out scaled through partnerships with development partners such as the World Food Programme to reach a total of 1,000 beneficiaries. | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 8. How are activities in this protocol linked to those of others? | | | | | | | | | | | | | | | | |
| This activity will be used to optimize approaches within establishment of community seed banks to ensure there is impact on nutrition outcomes. The M&E scientists may use the platform established to collect data. | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 9. Gantt chart | | | | | | | | | | | | | | | | |
|  | **Activity** | | | | | | | Start | | | | End | | Workdays | | |
| 1. | Data cleaning, analysis and write up | | | | | | | Tue 10/01/19 | | | | Mon 3/30/20 | | 130 | | |
| 2. | Learning and sharing /Thesis | | | | | | | Mon 2/03/20 | | | | Mon 3/30/20 | | 41 | | |

# Consolidated ESA project budget

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sub-activity** | **Lead** | **CIAT** | **CIMMYT-B** | **CIMMYT-T** | **ICRAF** | **ICRISAT** | **IITA** | **MSU** | **TARI-Hombolo** | **WorldVeg** | **WUR** | **Total** |
| Outcome 1: Productivity, diversity, and income of crop-livestock systems in selected agro-ecologies enahnced under climate variability | | | | | | | | | | | | |
| Output 1.1: Demand-driven, climate-smart, integrated crop-livestock research products (contextualized technologies) for improved productivity, diversified diets, and higher income piloted for specific typologies in target agro-ecologies and scaled in Outcomes 4 and 5 | | | | | | | | | | | | |
| Activity 1.1.1: Assess and iteratively improve resilient crop-crop and crop-livestock integration systems [Assess and iteratively improve crop-livestock combinations from Phase I] | | | | | | | | | | | | |
| Sub-activity 1.1.1.1 Farm level evaluation of elite drought tolerant (DT) hybrids and other validated SI soil & water conservation and fertilizer technologies to determine the human condition, social and economic benefits associated with these hybrids | CIMMYT-B |  | 42,814 |  |  |  |  |  |  |  |  | 42,814 |
| sub-activity 1.1.1.2 Investigations on the medium to long-term impacts of Sitechnologies (improved soi fertility management, improved germplasm, crop combinations, nutrient and water management) on vcrop productivity on multi-locational field sites and baby trials | MSU |  |  |  |  |  | 2,250 | 66,590 |  |  |  | 68,840 |
| Sub-activity 1.1.1.3 Determining the productivity of groundnut as a function of generation x variety x density interactions in two contrasting agroecologies | MSU |  |  |  |  |  |  | 21,190 |  |  |  | 21,190 |
| Sub-activity 1.1.1.4 Exploring the productivity of goats under controlled breeding and feeding regimes among young breeding female goats in crop-livestock systems in Malawi | MSU |  |  |  |  |  |  | 0 |  |  |  | 0 |
| Sub-activity 1.1.1.5: Determining the productivity and resilience benefits of Gliricidia-based cropping systems | ICRAF |  |  |  | 46,221 |  | 800 |  |  |  |  | 47,021 |
| Sub-activity 1.1.1.6 Assess the yield, economic and BNF (biological nitrogen fixation) benefits of innovative approaches addressing the pigeon pea and common bean productivity within maize-based cropping system and variable weather | CIAT | 82,949 |  |  |  |  | 2,780 |  |  |  |  | 85,729 |
| Sub-activity 1.1.1.7 Monitoring the impact of weather and climate variability on the productivity and resilience of maize-legume croppings of Kongwa and Kiteto, Tanzania | SUA-soils |  |  |  |  |  |  |  |  |  |  | 0 |
| Activity 1.1.2: Evaluate and implement pathways that are effective at improving access to seeds and clonal materials of modern varieties of legumes, cereals, vegetables, forages and livestock | | | | | | | | | | | | |
| Sub-activity 1.1.2.1 Assessment of the benefits of management technologies on performance of improved vegetable varieties (season 2) | WorldVeg |  |  |  |  |  | 2,250 |  |  | 42,905 |  | 45,155 |
| Output 1.2: Demand-driven, labor-saving and gender-sensitive research products to reduce drudgery while increasing labor efficiency in the production cycle piloted for relevant typologies in target areas [and scaled in Outcomes 4 and 5] | | | | | | | | | | | | |
| Activity 1.2.2: Co-adapt existing mechanization options with target communities | | | | | | | | | | | | |
| Sub-activity 1.2.2.1 Use of tractor mounted ripper tillage implement for enhancing soil water infiltration and moisture conservation in semi-arid areas of Kiteto, Manyara Region | TARI Hombolo |  |  |  |  |  |  |  | 15,707 |  |  | 15,707 |
| Output 1.3: Tools (including ICT-based) and approaches for disseminating recommendations in relation to above research products, integrated in capacity development [and used in Outcomes 4 and 5] | | | | | | | | | | | | |
| Activity 1.3.1: Conduct extrapolation domain analysis based on GIS, agro-ecology, and crop model-generated information to establish the potential of technologies for geographical reach | | | | | | | | | | | | |
| Sub-activity 1.3.1.1 Farmer/Extension messaging (forage production and use, crop residue processing and use and feed rations) using MWANGA | ILRI |  |  |  |  |  |  |  |  |  |  |  |
| Sub-activity 1.3.1.2 Produce regionally releveant extrapolation domain maps for validated conservation agriculture practices | IITA |  |  |  |  |  | 15,000 |  |  |  |  |  |
| Sub-activity 1.3.1.3 Ex-ante impact assessment with Trade off Analsys Model for Multi Dimensional Impact Assessment (TOA-MD) for regional relevance of evaluated Africa RISING technologies | IITA |  |  |  |  |  | 24,000 |  |  |  |  | 24,000 |
| **TOTAL Outcome 1** |  | **82,949** | **42,814** | **0** | **46,221** | **0** | **47,080** | **87,780** | **15,707** | **42,905** | **0** | **350,456** |
| Outcome 2: Natural resource integrity and resilience to climate change enhanced for the target communities and agro-ecologies | | | | | | | | | | | | |
| Output 2.1: Demand-driven research products for enhancing soil, land and water resources management to reduce household/community vulnerability and land degradation piloted in priority agro-ecologies [and scaled in Outcome 5] | | | | | | | | | | | | |
| Activity 2.1.1: Characterize current practices in ESA through identifying formal and informal arrangements for access to and use of water and land resources | | | | | | | | | | | | |
| Sub-activity 2.1.1.1 Assessing the buffer and adaptive capacity to harness the resilience of different farm types | WUR |  |  |  |  |  |  |  |  |  | 4,800 | 4,800 |
| Output 2.2: Innovative options for land and water management in selected farming systems demonstrated at strategically located learning sites [and scaled in Outcome 5] | | | | | | | | | | | | |
| Activity 2.2.1 Set up demonstration and learning sites in target ESA communities | | | | | | | | | | | | |
| Sub-activity 2.2.1.1 Component long-term trials on maize/ legume intercropping strategies with pigeon peas, lablab, and cowpea | CIMMYT-T |  |  | 40,899 |  |  |  |  |  |  |  | 40,899 |
| Sub-activity 2.2.1.2 Investigations on nutrient and water management for climate resilience along a climate gradient in southern Malawi | MSU |  |  |  |  |  | 2,250 | 50,590 |  |  |  | 52,840 |
| Sub-activity 2.2.1.3 Test climate-smart farming practices (tied ridges, weather-informed varieties, cover crops integration [cowpea, lablab, medium duration pigeon pea]) for increasing productivity of maize-legume system under variable weather conditions | CIAT | 46,084 |  |  |  |  | 2,780 |  |  |  |  | 48,864 |
| Sub-activity 2.2.1.4 Land rehabilitation through the integration of fodder trees and grass forage species in dryland farming | ICRAF |  |  |  | 33,814 |  | 800 |  |  |  |  | 34,614 |
| Sub-activity 2.2.1.5 SUA-3 Evaluation of land rehabilitation benefits of shelterbelts and contours (Soil and plant sampling from ICRAF and TARI Hombolo sites) | SUA-soils |  |  |  |  |  |  |  |  |  |  | 0 |
| Sub-activity 2.2.1.6 Validation of residual tied ridging as a labor-saving technology in semi-arid Areas of Central Tanzania | TARI-Hombolo |  |  |  |  |  | 2,250 |  | 23,016 |  |  | 25,266 |
| **TOTAL Outcome 2** |  | **46,084** | **0** | **40,899** | **33,814** | **0** | **8,080** | **50,590** | **23,016** | **0** | **4,800** | **207,283** |
| Outcome 3: Food and feed safety, nutritional quality, and income security of target smallholder families improved equitably (within households) | | | | | | | | | | | | |
| Output 3.1: Demand-driven research products to reduce post-harvest losses and improve food quality and safety piloted in target areas [and scaled in outcome 5) | | | | | | | | | | | | |
| Activity 3.1.1 Conduct packaging and delivery of post-harvest technologies through community and development partnerships with iterative review, refining and follow-up | | | | | | | | | | | | |
| Sub-activity 3.1.1.1 Assess the impact of nutritional messaging on farmers' nutritional knowledge, attitude and practices and household nutrition status, in partnership with IDP | WorldVeg |  |  |  |  |  |  |  |  | 28,905 |  | 28,905 |
| Sub-activity 3.1.1.2 Evaluate influence of farmer storage structures and environemnt on physical and economic losses abatement by hermetic storage devices | IITA |  |  |  |  |  | 91,000 |  |  |  |  | 91,000 |
| Output 3.2: Nutritional quality improved through increased accessibility and use of nutrient-dense crops and livestock products | | | | | | | | | | | | |
| Activity 3.2.1: Promote and deploy nutrient-rich crop varieties and livestock feed resources in target communities | | | | | | | | | | | | |
| Sub-activity 3.2.1.1. Elucidate pathways to sustainable adoption of nutrient diets and aflatoxin mitigation practices in rural communities of Central Tanzania | ICRISAT |  |  |  |  | 12,800 |  |  |  |  |  | 12,800 |
| Sub-activity 3.2.1.2 Promote farmer production of nutrient dense (Zn, Fe) SER83 and NUA45 bean varieties produced by CIAT during 2018 | MSU |  |  |  |  |  |  | 57,090 |  |  |  | 57,090 |
| Sub-activity 3.2.2.3 Determining the quality and safety of locally produced legume grain-derived complementary foods and adoption in Dedza District | MSU |  |  |  |  |  |  | 0 |  |  |  | 0 |
| Sub-activity 3.2.1.4 Assess the contribution of the farming systems interventions in narrowing the food and nutrient gaps in Kongwa and Kiteto and the probability of smallholder farmers to meet them | ICRISAT |  |  |  |  | 29,700 | 4,000 |  |  |  |  | 33,700 |
| Output 3.3: Capacity of farming communities and partners to consume nutrient-dense crops and livestock products enhanced | | | | | | | | | | | | |
| **TOTAL Outcome 3** |  | **0** | **0** | **0** | **0** | **42,500** | **95,000** | **57,090** | **0** | **28,905** | **0** | **223,495** |
| Outcome 4: Functionality of input and output markets and other institutions to deliver demand-driven sustainable intensification research products improved | | | | | | | | | | | | |
| Output 4.1: Access to profitable markets for smallholder farming communities and priority value chains facilitated | | | | | | | | | | | | |
| Outcome 5: Partnerships for the scaling of sustainable intensification research products and innovations operationalized | | | | | | | | | | | | |
| Output 5.1: Opportunities for the use and adoption of sustainable intensification technologies identified for relevant farm typologies | | | | | | | | | | | | |
| Activity 5.1.1: Farmer participatory experimentation with crop and soil management and integrated crop-livestock technologies in on-farm situations | | | | | | | | | | | | |
| Sub-activity 5.1.1.1 Continued experimentation in 6 target communities of Eastern Zambia and 9 communities in Central and Southern Malawi with already established clustered CA trials | CIMMYT Thierf. |  |  | 104,674 |  |  |  |  |  |  |  | 104,674 |
| Sub-activity 5.1.1.2 Explore the productivity domains of selected legumes and cereals to elucidate their best fitting cropping system at community/landscape level and their dissemination | ICRISAT |  |  |  |  | 48,200 | 4,000 |  |  |  |  | 52,200 |
| Sub-activity 5.1.1.3 Engage develpoment partners to identify technologies of interest for partnership dissemination | ILRI |  |  |  |  |  |  |  |  |  |  | 0 |
| Sub-activity 5.1.1.4 Case-studies: Application of SI technologie use among farmers interacting with Africa RISING at different intensities | MSU/CIMMYT Thierf |  |  | 36,099 |  |  |  | 25,590 |  |  |  | 61,689 |
| Activity 5.1.2 Use farm trial data to apply crop simulation models (APSIM) and assess performance over space and time, including assessment of climate-smart technologies to establish the poiotential for adaptation and mitigation | | | | | | | | | | | | |
| Sub-activity 5.1.2.1 Apply APSIM crop simulation model to assess changes in resource use efficiencies, productivity and profitability of the different cropping systems in Kongwa, Kiteto and Iringa in Tanzania | ICRISAT |  |  |  |  | 19,900 |  |  |  |  |  | 19,900 |
| Sub-activity 5.1.2.2 Evaluate the potential contributions of integrated soil-fertility management around the five SIAF domains with emphasis on Africa RISING interventions in Tanzania | CIAT | 40,610 |  |  |  |  | 2,250 |  |  |  |  | 42,860 |
| Activity 5.1.3: Establish adaptive field experiments with mineral and animal-derived organic manure | | | | | | | | | | | | |
| Sub-activity 5.1.3.1 Rainfall-responsive nitrogen fertilization strategies: in search of increased nitrogen use efficiency by smallholder farmers under rainfed conditions | MSU |  |  |  |  |  |  | 26,590 |  |  |  | 26,590 |
| Sub-activity 5.1.3.2 Assessing the effect of residue quantity and quality and water conservation on maize productivity and nitrogen dynamics on smallholder farms in Malawi | MSU |  |  |  |  |  |  | 66,090 |  |  |  | 66,090 |
| Sub-activity 5.1.3.3 Assessing integrative effect of in situ rainwater harvesting and fertilizer microdosing on crop yield, water and nutrient use efficiency in Kongwa district | SUA-soils |  |  |  |  |  | 2,250 |  |  |  |  | 2,250 |
| Activity 5.1.4: Demonstrate the use and impact of crop residues, forages, and other organic resources as animal feed and nutrient resources | | | | | | | | | | | | |
| Sub-activity 5.1.4.1 Test the effect of feeding Napier grass and maize stover supplemented with bean haulms at different levels of milk yield under smallholder farmer conditions | ILRI |  |  |  |  |  |  |  |  |  |  |  |
| Sub-activity 5.1.4.2 Demonstrate the effect of home-made feed rations based on Gliricidia sepium and vegetable waste on productivity of selected strains of chickens | ILRI |  |  |  |  |  |  |  |  |  |  | 0 |
| Activity 5.1.6: Disseminate best-fit integrated crop-livestock technologies to reach and have effect on small-scale farmers in a landscape context | | | | | | | | | | | | |
| Sub-activity 5.1.6.1 Small-scale piloting of FarmMATCH – a framework for typology-based targeting and scaling of agricultural innovations | WUR |  |  |  |  |  | 2,000 |  |  |  | 17,000 | 19,000 |
| Activity 5.1.7: Conduct cost-benefit and gender analysis coupled with other socio-economic analyses to identify and quantify adoption constraints and opportunities for different farmer contexts | | | | | | | | | | | | |
| Sub-activity 5.1.7.1 Socio-economic studies on cost-benefits of CA systems, labor, nutrition and gender in target communities of Malaw8i and Zambia conducted | CIMMYT T |  |  | 47,349 |  |  |  |  |  |  |  | 47,349 |
| Sub-activity 5.1.7.2 Gender analysis of soil and water conservation technologies | IITA |  |  |  |  |  | 2,250 |  |  |  |  | 2,250 |
| Sub-activity 5.1.7.3 Innovative farmer survey applying SI principles in CA long-term trials in Malawi and Zambia | CIMMYT T |  |  | 34,849 |  |  |  |  |  |  |  | 34,849 |
| Output 5.2: Strategic partnerships with public and private, initiatives for the diffusion, and adoption of research products established | | | | | | | | | | | | |
| Activity 5.2.1: Map and assess relevant stakeholders to establish dialogue for the exploration of mutual synergies for scaling delivery of validated technologies | | | | | | | | | | | | |
| Sub-activity 5.2.1.1 Engage able and willing partners to develop a strategy and implementation framework for scaling up intensification technologies in semi-arid ecologies of central Tanzania | ICRISAT |  |  |  |  | 16,500 |  |  |  |  |  | 16,500 |
| Activity 5.2.2: Leverage/link and integrate (engagement and outreach) with existent initiatives including Government extension systems to support and encourage the delivery pathways | | | | | | | | | | | | |
| Sub-activity 5.2.2.1 Support the Ministry of Agriculture and NGO extension in scaling CA systems in Eastern Zambia and Malawi | CIMMYT T |  |  | 14,474 |  |  |  |  |  |  |  | 14,474 |
| Sub-activity 5.2.2.2 Engage with seed companies to accelerate release & scaling of new DT hybrids | CIMMYT-B |  | 13,418 |  |  |  |  |  |  |  |  | 13,418 |
| Sub-activity 5.2.2.3 Partnership with Iles de Paix (IDP) for increasing the adoption of improved vegetable varieties and good agricultural practices for scaling delivery of validated technologies | WorldVeg |  |  |  |  |  |  |  |  |  |  | 0 |
| Sub-activity 5.2.2.4 Partnership with the LEAD foundation to take to scale soil and water management technologies in erosion-prone areas | TARI-Hombolo |  |  |  |  |  |  |  | 20,276 |  |  | 20,276 |
| Output 5.3: Gender-sensitive decision support tools for farmers to assess technology-associated risk and opportunities used by partners | | | | | | | | | | | | |
| Activity 5.3.1: Identify and communicate gender-sensitive decision support technologies in the context of different farm typologies | | | | | | | | | | | | |
| Sub-activity 5.3.1.1 Role of gender from farm-to-fork and the market of grain legumes and dryland cereals in Kiteto and Kongwa (data already collected and partly presented; more in-depth analysis needed) | ICRISAT |  |  |  |  |  |  |  |  |  |  |  |
| **TOTAL Outcome 5** |  | **40,610** | **13,418** | **237,443** | **0** | **84,600** | **12,750** | **118,270** | **20,276** | **0** | **17,000** | **544,367** |
| Indirect costs | | 20,357 | 8,435 | 41,751 | 14,406 |  |  | 66,274 | 5,000 | 15,870 | 2,775 | 174,868 |
| **TOTAL** | | **190,000** | **64,667** | **320,093** | **94,441** | **127,100** | **162,910** | **380,003** | **63,999** | **87,680** | **24,575** | **1,500,468** |

# Feed the Future and Custom Indicators

|  |  |  |
| --- | --- | --- |
| **Indicator code** | **Feed the Future or Custom** | **FY 2017**  **Target** |
|  | |  |
| **4.5.2(42): (4.5.2-28)** | Number of for-profit private enterprises, producers’ organizations, water users’ associations, women’s groups, trade and business associations and community-based organizations (CBOs) that applied improved organization-level technologies or management practices with USG assistance |  |
|  | Type of organization |  |
|  | Private enterprises (for profit) |  |
|  | Producers organizations |  |
|  | Water users’ associations |  |
|  | Women's groups |  |
|  | Trade and business associations |  |
|  | Community-based organizations (CBOs) |  |
|  | Disaggregates Not Available |  |
|  | New/Continuing |  |
|  | New |  |
|  | Continuing |  |
|  | Disaggregates Not Available |  |
| **4.5.2(2)** | Number of ha of land under improved technologies or management practices with USG assistance |  |
|  | Technology type |  |
|  | crop genetics (maize, p'pea, sorghum, bambara, g/nut, livestock forages) |  |
|  | pest management |  |
|  | disease management (MLN) |  |
|  | soil-related |  |
|  | irrigation |  |
|  | water management |  |
|  | climate mitigation or adaptation |  |
|  | other |  |
|  | total w/one or more improved technology |  |
|  | Disaggregates Not Available |  |
|  | New/Continuing |  |
|  | New |  |
|  | Continuing |  |
|  | Disaggregates Not Available |  |
|  | Sex |  |
|  | Male |  |
|  | Female |  |
|  | Joint |  |
|  | Association-applied |  |
|  | Disaggregates Not Available |  |
| **EG.3.2-1: (4.5.2-7)** | Number of individuals who have received USG-supported short-term agricultural sector productivity or food security training |  |
|  | Type of individual |  |
|  | Producers |  |
|  | People in government |  |
|  | People in private sector firms |  |
|  | People in civil society |  |
|  | Disaggregates Not Available |  |
|  | Sex |  |
|  | Male |  |
|  | Female |  |
|  | Disaggregates Not Available |  |
| **4.5.2(11):** | Number of food security private enterprises (for profit), producers organizations, water users associations, women's groups, trade and business associations, and community-based organizations (CBOs) receiving USG assistance (RIA) (WOG) |  |
|  | Type of organization |  |
|  | Private enterprises (for profit) |  |
|  | Producers organizations |  |
|  | Water users associations |  |
|  | Women's groups |  |
|  | Trade and business associations |  |
|  | Community-based organizations (CBOs) |  |
|  | Disaggregates Not Available |  |
|  | New/Continuing |  |
|  | New |  |
|  | Continuing |  |
|  | Disaggregates Not Available |  |
| **EG.3.2-17: (4.5.2-5)** | Number of farmers and others who have applied improved technologies or management practices with USG assistance |  |
|  | New/Continuing |  |
|  | New |  |
|  | Continuing |  |
|  | Disaggregates Not Available |  |
|  | Sex |  |
|  | Male |  |
|  | Female |  |
|  | Disaggregates Not Available |  |
| **4.5.2(12):** | Number of public-private partnerships formed as a result of FTF assistance |  |
|  | Agricultural production (NAFAKA) |  |
|  | Agricultural post harvest transformation |  |
|  | Nutrition (Tuboreshe Chakula?) |  |
|  | Multi-focus |  |
|  | Other |  |
|  | Disaggregates Not Available |  |
| **EG.3.2-x27: (4.5.2-27)** | Number of members of producer organizations and community-based organizations receiving USG assistance (S) |  |
|  | Type of organization |  |
|  | Producers’ organization |  |
|  | Non-producer-organization CBO |  |
|  | Disaggregates Not Available |  |
|  | Sex |  |
|  | Male |  |
|  | Female |  |
|  | Disaggregates Not Available |  |
| **(4.5.2(42): (4.5.2-28).** | Number of private enterprises (for profit), producers organizations, water users associations, women's groups, trade and business associations, and CBOs that applied improved technologies or management practices as a result of USG assistance |  |
|  | Type of organization |  |
|  | Private enterprises (for profit) |  |
|  | Producers organizations |  |
|  | Water users associations |  |
|  | Women's groups |  |
|  | Trade and business associations |  |
|  | Community-based organizations (CBOs) |  |
|  | Disaggregates Not Available |  |
|  | New/Continuing |  |
|  | New |  |
|  | Continuing |  |
|  | Disaggregates Not Available |  |
| **4.5.2(39):** | Number of technologies or management practices in one of the following phases of development: (Phase I/II/III) (S) |  |
|  | Phase 1 Number of new technologies or management practices under research as a result of USG assistance |  |
|  | Phase 2 Number of new technologies or management practices under field testing as a result of USG assistance |  |
|  | Phase 3 Number of new technologies or management practices made available for transfer as a result of USG assistance |  |
|  | Number of children under 2 (0-23 months) reached with community-level nutrition interventions through USG-supported programs |  |
|  | Male |  |
|  | Female |  |
|  | Number of individuals receiving nutrition-related professional training through USG-supported programs |  |
|  | Male |  |
|  | Female |  |
|  |  |  |
| **1** | Number of community-based, regional and national networks and partners established to exchange knowledge and information. |  |
| **2** | Number of on-farm demonstrations established |  |
| **3** | Number of field days organized |  |
| **4** | Number of youth and women participating in project activities |  |
| **5** | Youth |  |
| **6** | Women |  |
| **7** | Number of households using climate information or implementing risk-reducing actions to improve resilience to climate change |  |
| **8** | Number of guidelines and training materials developed by AR researchers? Maybe disaggregate by topic of training |  |
| **9** | Number of graduate (MSc and PhD) students trained as part of AR |  |
| **10** | PhD |  |
| **11** | New |  |
| **12** | Continuing |  |
| **13** | MSc |  |
| **14** | New |  |
| **15** | Continuing |  |
| **16** | Number of AR project reports produced |  |
| **17** | Number of AR-based journal papers published |  |
| **18** | Number of posters, policy briefs, leaflets and films produced by AR researchers |  |
| **19** | Number of radio and TV discussions organized by AR researchers |  |
| **20** | Number of households benefiting from nutrition intervention due to AR |  |
| **21** | Percent change in dietary diversity score of farm household in the project intervention communities. |  |
| **22** | Number of households, especially women with access to home or community garden due to AR |  |
| **23** | Number of women and youth participating in production and marketing decisions as a result of AR |  |
| **24** | Youth |  |
| **25** | Women |  |
| **26** | Percent aflatoxin reduction at harvest through use of Aflasafe in the field |  |
| **27** | Number of published guidelines on market opportunities and market niches |  |
| **28** | Number of community-based producers' organizations established and/or strengthened for production, processing and marketing. |  |
| **29** | Number of households clustered to viable value chains by type of market orientation |  |
| **30** | Number of agricultural and nutritional enabling policies, regulations and administrative procedures recommended and communicated by AR researchers |  |
| **31** | Number of knowledge sharing centers and learning-alliances developed AR researchers within existing local and regional institutions. |  |
| **32** | Number of people trained in CSA including PICSA approach. |  |
| **33** | Number of farmers using climate information in their decision-making |  |

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